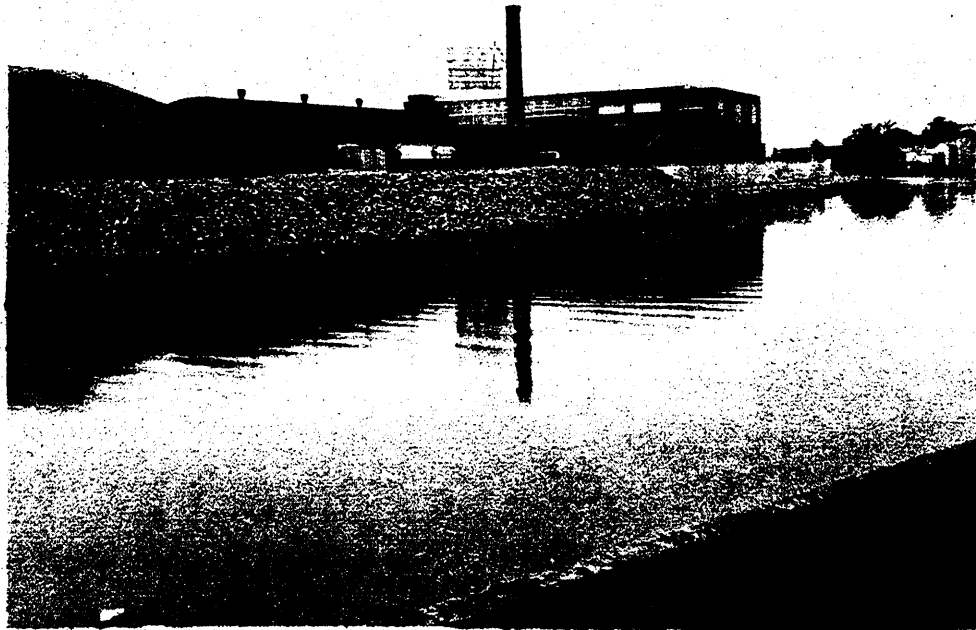


HURRICANE FLOOD CONTROL
OPERATION AND MAINTENANCE
MANUAL
FOR
FLOOD PROTECTION WORKS
PAWCATUCK, CONNECTICUT
PAWCATUCK RIVER



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

AUGUST 1963

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OPERATION

AND

MAINTENANCE

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FOREWARD

The successful functioning of flood protective works is not assured solely by construction of a system of adequate dikes, flood walls, flood gates, pumping station, and other appurtenant structures. If the system is to perform the functions for which it was designed, it must be carefully maintained during periods of normal river stages and properly operated during flood periods.

The need for proper maintenance cannot be too highly stressed in view of the fact that large damages may be incurred through failure of a critical element in flood time, caused by deterioration or damage that would have been eliminated by proper maintenance.

Necessary maintenance and proper operation require that responsible local persons have a thorough understanding of the functions of the various units of the system and the best methods of maintaining the system and operating it during flood emergencies. It is the purpose of this manual to provide complete information so that all parties may know their responsibilities in maintaining and operating the flood protection system in accordance with the regulations of the Secretary of the Army as amplified by this manual.

The Flood Control Regulations for Maintenance and Operation of Flood Control Works quoted herein were approved by the Acting Secretary of War on 9 August 1944. Upon establishment of the Department of Defense the improvement of rivers and harbors and other waterways for flood control and other purposes, formerly under the jurisdiction of the Secretary of War, became the responsibility of the Secretary of the Army. Reference therein to the Secretary of War and War Department shall be construed to mean, respectively, the Secretary of the Army and Department of the Army. Where reference is made to the District Engineer in the Regulations included in this manual, it shall be construed to mean the Division Engineer, U.S. Army Engineer Division, New England, Waltham, Massachusetts.

Operation of the Pawcatuck Local Protection Project during flood periods involves closing of fire pump suction lines leading to the Cottrell and Yardney Plants, closing the 48-inch gravity discharge sluice gate and opening the 48-inch sluice gate into the sump in the pumping station, operating the pumps, and closing the vehicular gates on Mechanic Street.

The Town of Stonington shall be responsible for the operation of the Pawcatuck Local Protection Project. The U. S. Weather Bureau at Hillsgrove Airport, Rhode Island, is responsible for the forecasting of hurricanes and abnormally high tides in the Pawcatuck area. Operating personnel in Stonington shall establish a liaison with the Weather Bureau officials in order to receive "advisories" promptly. A report shall be prepared following each operation and a copy forwarded to the New England Division.

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SECTION I

INTRODUCTION

1. AUTHORIZATION

Construction of the hurricane local flood protection project at Pawcatuck, Connecticut was authorized by Public Law 86-645, Section 203 adopted 14 July 1960. The project was constructed substantially in accordance with the recommendations of the Chief of Engineers, in House Document Numbered 212, 86th Congress.

2. LOCATION

Pawcatuck, a borough of the Town of Stonington, is located in New London County, Connecticut on the west bank of the Pawcatuck River across from Westerly, Rhode Island. It is situated in the southeastern part of Connecticut about 15 miles east of New London, Connecticut and approximately 5 miles upstream from the mouth of the Pawcatuck River at Little Narragansett Bay.

3. DESCRIPTION OF PROJECT

The project begins at high ground south of the Cottrell Company Plant and extends north along the west bank of the Pawcatuck River for a distance of approximately 2220 feet, consisting of 1740 feet of stone-faced earth dike and 480 feet of concrete flood wall. The project then continues in a westerly direction along the northerly property line of the Yardney Electric Company in the form of a concrete flood wall for a distance of 300 feet joining the north vehicular gate structure at Mechanic Street. A concrete flood wall from the west side of the north vehicular gate structure continues in a westerly direction for a distance of 160 feet to a stone-faced earth dike which extends for 60 feet to high ground at the New York, New Haven and Hartford Railroad embankment. An additional section of the project, approximately 170 feet in length, is located at Mechanic Street, adjacent to and south of the Cottrell Company's railroad spur track. It consists of a vehicular gate structure across Mechanic Street with a stone-faced earth dike on both sides, extending to high ground.

A pumping station (24,000 gpm capacity) equipped with two diesel engine driven pumps and one electric-driven sump pump, is located in the southeast corner of the Yardney Electric Company's property adjacent to the concrete flood wall along the west bank of the Pawcatuck River. The pumping station is used during hurricane floods to remove interior runoff and drainage from within the protected area. An intercepting drain line located on the

land side of the dike and concrete flood wall will convey interior drainage, sewage, and seepage flows to an inlet chamber built in conjunction with the pumping station. At this point the flow would be directed by means of sluice gates, to pass through the pumping station during times of flooding and through a 48-inch outfall directly to the river.

4. PROTECTION PROVIDED

The area protected located on the west side of the Pawcatuck River consists of approximately 34 acres of land, comprised principally of two major industrial plants, 27 residential properties, and about one-half mile of local streets. The constructed project will provide protection from hurricane-induced tidal flooding up to an elevation of 17 feet above mean sea level.

5. CONSTRUCTION HISTORY

Construction of the project was initiated on 12 June 1962 and was completed in July of 1963. The project was constructed by Wes-Julian Construction Corporation of Dedham, Massachusetts. Approximate quantities of materials used in construction of this project are as follows:

Impervious Fill	23,900	C.Y.
Random Fill	4,100	C.Y.
Gravel Fill	17,300	C.Y.
Granular Fill	660	C.Y.
Gravel Bedding	3,900	C.Y.
Stone Slope Protection	8,900	C.Y.
Filter Stone	2,900	C.Y.
Filter Sand	1,950	C.Y.
Concrete Work	2,900	C.Y.
Steel Reinforcement	317,000	Lbs.
Vehicular Gates	2	Each
Pumping Station	1	Each
Intake Structures	2	Each
Topsoiling and Seeding	4,500	S.Y.
B.C.C.M. Pipe-12"	1,900	L.F.
R.C. Pipes	1,850	L.F.
Clay Pipe	70	L.F.
Cast Iron Pipes	580	L.F.
Drain Manholes	21	Each
Seepage Control in Buildings No. 2 and 5 of Cottrell Company	1	Job

6. PLANS

Full size tracings of "as-built" construction drawings have been provided the Town of Stonington, Connecticut.

A reduced size set of "as-built" drawings showing the project as actually constructed are included in Appendix F.

SECTION II

LOCAL COOPERATION REQUIREMENTS

7. FLOOD CONTROL ACTS

Section 3 of the Flood Control Act approved June 22, 1936 (Public Law No. 738, 74th Congress) provides, "That hereafter no money appropriated under authority of this Act shall be expended on the construction of any project until States, political subdivision thereof, or other responsible local agencies have given assurances satisfactory to the Secretary of War that they will:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project;

b. Hold and save the United States free from damages due to the construction works;

c. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War."

The legislation, under which construction of the Pawcatuck, Connecticut Hurricane Flood Protection Project was authorized by the Chief of Engineers, states that "the provisions of local cooperation specified in Section 3 of the Flood Control Act of June 22, 1936, as amended, shall apply."

Assurances were also required that local interests would: Accomplish without cost to the United States all alterations and relocations of buildings, streets, storm drains, and utilities made necessary by reason of the construction; bear 30 percent of the total first cost of the project including the value of lands, easements, rights-of-way, alterations, and relocations.

8. ASSURANCES

The Town of Stonington, acting by and through its Flood and Erosion Control Board, executed the formal Assurance for the Pawcatuck, Connecticut Hurricane Flood Protection Project and caused the Seal of the Town of Stonington to be affixed thereto on 22nd day of January 1962 and was accepted for and on behalf of the United States of America by the Division Engineer on 30 January 1962. Copies of the formal assurances are included in Appendix B. Local interests have met all requirements except operation and maintenance of the project, which they have agreed to do in accordance with this manual.

SECTION III

GENERAL REGULATIONS

9. PURPOSE OF THIS MANUAL

The purpose of this Manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on 9 August 1944, and published in this volume as Appendix A. In executing assurances of local cooperation, the Town of Stonington, Connecticut, acting by and through its Flood and Erosion Control Board has agreed to maintain and operate the completed works in accordance with these regulations. The regulations which are intended to cover all local flood protection projects constructed by the Corps of Engineers throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this Manual for maintenance and operation of the Pawcatuck, Connecticut project are intended to supplement the regulations to permit obtaining all the benefits and protection against floods for which the project was designed. Failure to maintain and operate the project as required by the regulations and as detailed herein can cause severe property losses and loss of life and can result in an irreparable loss of confidence in the flood protection system by citizens who have invested their funds on the basis of the protection which it provides.

10. GENERAL RULES AND REGULATIONS

Paragraph 208.10 (a) of the regulations prescribed by the Secretary of War gives general rules for the maintenance and operation of structures and facilities constructed by the United States for local flood protection. Applicable portions are quoted below to avoid the necessity for cross reference and are further defined by remarks under each quotation.

"(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

These requirements cannot be overstressed, and the Town authorities must make adequate provisions for funds, personnel, equipment and materials to allow for the proper maintenance and operation of the flood protective works.

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by law, shall appoint a permanent committee consisting of or headed by an official here-in-after called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States."

(a) The committee should be composed of competent members, preferably men experienced in engineering or construction work of a nature similar to the flood protection works. The committee must be given broad authority to carry out its responsibilities. The name, address, and office and home telephone numbers of the Superintendent, and any changes thereof, shall be promptly furnished the Division Engineer.

"(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times."

Approximately 1000 sand bags and tools such as picks and shovels for 10 men should be obtained and held in reserve to meet any ordinary emergency that may occur during flood periods. Borrow pits for embankment materials should be secured and sources of where to obtain additional supplies of materials, tools, and equipment should be well established in order that these articles can be obtained quickly in case of an emergency. The sand and sand bags should be kept separate until time of use in order to avoid the decay of the bags. The following is a break down of the 1000 sand bags required and those areas where particular attention should be given.

(a) North Vehicular Gate. - Approximately 200 sand bags and 8 cubic yards of sand stored separately to fill them, should be held in reserve to seal off the bottom of the gate.

(b) South Vehicular Gate. - Approximately 200 sand bags and 8 cubic yards of sand stored separately to fill them, should be held in reserve to seal off the bottom of the gate.

(c) Pump House (or some other central location). - Approximately 600 sand bags and 24 cubic yards of sand stored separately to fill them should be held in reserve in case it is necessary to stop leaks through the dike and wall and to control sand boils and seepage behind the dike and concrete wall.

"(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities."

The disposal of rubbish, erection of fences or barriers, wearing of footpaths or any form of trespassing on the project shall be prohibited.

"(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representatives that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work."

Any contemplated improvements or alterations as outlined above must be submitted to the U.S. Army Corps of Engineers, New England Division, Waltham, Massachusetts, and the approval of the Division Engineer obtained prior to the Town authorizing the work. Approval should also be secured for alterations which may reduce the height of banks in areas outside the project rights-of-way or for extensive or permanent excavations in the vicinity of the dikes. Where temporary excavations are unavoidable, provisions shall be made to backfill the excavation in the event of a flood. All requests for approval shall be in writing and complete drawings in duplicate, one set of which shall be in reproducible form, must be submitted along with a full description of the work intended. The municipality will be held responsible for obtaining prior approval from the Corps of Engineers for any improvements or alterations proposed by itself, private parties or any public parties. Local interests shall furnish the Division Engineer as-built drawings in duplicate of the completed work.

"(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works."

Refer to Paragraph 13 of this manual for instructions on submitting reports.

"(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

The Division Engineer or his representatives will make a periodic inspection of the protective works to determine if the project is being properly maintained and operated by municipality.

"(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made."

The municipality should maintain and repair the facilities promptly as required and not wait for the Division Engineer to call such matters to its attention. Upon request, the Division Office will advise the Town regarding any major repairs to the facilities.

"(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendents organization during flood periods."

"(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations."

The flood control committee should familiarize itself with the contents of this manual. The local authorities are encouraged to call on the Division Office of the Corps of Engineers for any additional advice or instructions required by them in carrying out the Town's obligations for maintaining and operating the flood protection facilities.

11. MAINTENANCE

a. Maintenance in this manual refers to the care and upkeep of the completed construction work which was turned over to the Town. The Corps of Engineers, through its Division Engineer, endeavored to design the safest system possible, and to see that it was well constructed. If the work is neglected, there will be deterioration and possible failure in flood time when there is dire need of dependable protection.

b. The organization which is responsible for maintenance should always give thought to what it will do when the need arises to operate. From experience gained through maintaining the different parts of the system, it will be in a position to use them effectively in time of stress.

c. Maintenance involves regular inspection of the entire system. The purpose of the inspection is to detect any deterioration or faulty operation that needs repair.

d. Each of the major features of your project will be discussed separately with respect to the points that should be watched, as developed through the use of similar structures over a long period of years.

12. OPERATION

Operation in this manual refers to the actual use of the various features of the protection works during flood periods of the river. It is intended that the procedure outlined herein will be sufficient to insure protection from floods to the design stage. However, advice relative to operation may be secured at any time from the Corps of Engineers, New England Division Office.

13. REPORTS

a. The regulations prescribed by the Secretary of War call for semiannual reports to be submitted by the Superintendent to the Division Engineer, covering inspection, maintenance and operation. Inspection of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods and otherwise at intervals not exceeding 90 days as required by the regulations. The most severe storms in the area have been of the hurricane type of tropical origin that move up the eastern seaboard. They are most likely to occur during the late summer and autumn months, but floods can occur in any month of the year.

b. To assist the superintendent in making his inspections and reports, sample forms have been prepared and are included in Appendix E. The superintendent shall have additional copies printed for use in submitting his reports.

c. The semiannual reports should be submitted in triplicate to the Division Engineer each May and November. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The reports shall cover the following points:

(1) A description of the maintenance work performed in the preceding six months.

(2) The number and classification of men working on maintenance regularly and intermittently.

(3) Description of any work performed by contract on the repair or improvement of the project.

(4) Description of use or operation of the system during the period being reported.

(5) Suggestions relative to public cooperating and comments concerning public sentiment on the protection obtained are considered pertinent and desirable data for inclusion in the report, but such data are not required.

SECTION IV

HURRICANES

14. GENERAL INFORMATION

The Weather Bureau is responsible for issuing warnings of hurricanes which approach the U. S. Mainland. During the summer and fall, when most hurricanes occur, forecast offices at San Juan, Miami, New Orleans, Washington and Boston install special communications facilities and maintain a careful watch for the development of tropical storms and hurricanes.

As soon as there are definite indications that a hurricane is forming, even though it is a thousand miles or more from the mainland, the storm is given a name and the Weather Bureau begins issuing "advisories". The advisories are issued frequently throughout the day and night and tell where the storm is, how intense it is, and its speed and direction of movement.

If the hurricane moves toward the mainland, hurricane "watch" notices are included in the advisories and storm and hurricane warnings are issued. In addition, "bulletins" for press, radio and television are issued at frequent intervals to keep the public informed of the progress of the storm.

When a hurricane threatens any portion of the U. S. coast, special emergency warning centers are set up at Weather Bureau offices in the threatened area. Representatives of newspapers, radio and television stations, Civil Defense, Red Cross, city governments, etc., may obtain first hand information on the storm at the center. Special telephone and radio lines are used so that this vital information may be quickly disseminated to everyone concerned.

15. DESCRIPTION

Hurricanes are large revolving storms accompanied by violent destructive winds, heavy rains, and high waves and tides. Hurricanes originate in all tropical ocean areas except the South Atlantic and usually move from low to higher latitudes with increasing speed, size, and intensity.

The winds whirl counterclockwise (in the Northern Hemisphere) in the storm with the highest speeds in a circular band beginning at the edge of the "eye" and extending out 20 to 30 miles or more. In this area velocities may reach 150 miles per hour with brief gusts to even

higher speeds. At the center there is usually a small, cloudless core from 5 to 20 miles across. This core is called the "eye", since the sky is often clear or only partly cloudy and the winds are usually very light. The area of destructive winds along the path of a hurricane may be from 25 to 500 miles wide. As the storm develops and moves forward, it may traverse a path several thousand miles long, as measured from its birthplace in the Caribbean or Tropical Atlantic until it moves inland over the continent, or blows out into the North Atlantic.

While the winds of the hurricane are blowing at great speed around the center, the entire storm may move forward very slowly and sometimes even remain stationary for a short time. This is especially true while the hurricane is in the tropics, where the forward speed is usually 15 miles per hour or less. As the hurricane moves farther from the tropics, the forward speed usually increases and in extreme cases may reach 50 miles an hour or more.

The winds of a hurricane can do great damage. While they do not have the force of a tornado, they topple trees, blow over houses, tear down power lines, and even blow trains off their tracks. The greatest loss of life during hurricanes, however, is caused by drowning. As the storm moves forward, it often piles up huge waves which cut off or completely cover low-lying beaches and islands. The ocean level may rise 6 feet or more in a few minutes. Small boats are flung high on beaches. Giant waves pound and smash shore buildings, roads, and bridges, and may wash away long standing sand dunes.

Most hurricanes are accompanied by torrential rains which cause additional damage by flooding and destroying crops, washing out roads and bridges, and flooding low-lying communities.

16. HURRICANE WATCH

The U. S. Weather Bureau, Corps of Engineers, and the Town of Stonington will be alert to all hurricanes threatening the North Atlantic States. Both Federal agencies, represented locally by the U. S. Weather Bureau at Hillsgrove Airport, Rhode Island, and the New England Division at Waltham, Massachusetts, will closely follow all Weather Bureau advisories and maintain a continuous plot of the storm's position. New England Division will be available for assistance or advice to the Town of Stonington whenever desired. The Town will alert all personnel connected with operation of the project. Should the hurricane continue to approach the coast so as to constitute an appreciable threat to coastal areas, a "hurricane watch" is announced for the vulnerable areas. The "hurricane watch" does not

constitute a warning that the hurricane conditions are imminent, rather it indicates that the hurricane is close enough that every one in the area covered by the "watch" should listen for further advisories and be ready to take precautionary action in case warnings are issued. The town will staff the pumping station on a 24-hour basis. For further details see Appendix C of this report.

17. HURRICANE WARNING

As soon as the forecaster determines that a particular section of the coast will feel the full effects of a hurricane, he issues a "hurricane warning". Hurricane warnings specify coastal areas where winds of 75 mph or higher are expected to occur. When the warning is issued all precautions should be taken immediately against the full force of the storm. Hurricane warnings are seldom issued more than 24 hours in advance and sometimes, in case of unusual or erratic hurricane movement, they may be issued only a few hours in advance of the onset of hurricane conditions. It is therefore of utmost importance that precautionary actions be instituted immediately when a "hurricane warning" is announced.

Issuance of "hurricane warnings" does not mean that the center of the hurricane is always expected to pass inland over the area warned. Rather, the warnings indicate that winds of hurricane force are expected within the area of hurricane warning. Usually the winds gradually increase in velocity as the center approaches and may reach hurricane force as much as 6 hours or more before the center crosses the coast. Since dangerous winds may extend outward a considerable distance from the center of the storm, the area of danger is usually several times greater than that covered by the center itself. In some cases the center may "skirt" the coast and result in hurricane winds with the center never crossing the coast.

18. STORM WARNINGS

These are warnings for coastal areas indicating that winds of more than 32 mph, but of less than hurricane force, will occur. They are issued not only in connection with hurricanes but with other types of coastal storms. There are several circumstances under which they may be issued in connection with hurricanes. If a hurricane approaches close enough to cause strong winds but not close enough to cause hurricane conditions, "storm warnings" may be issued. Should the hurricane continue moving toward the coast, the "storm warnings" may be changed to "hurricane warnings", and "storm warnings" may be issued for other areas on either side of the expected hurricane path. For further details see Appendix C of this report.

SECTION V

DIKES

19. DESCRIPTION

The dikes constructed by the Corps of Engineers, as shown on Sheet Nos. 2 and 3, are located primarily along the west bank of the Pawcatuck River, east of Mechanic Street. Along the riverfront, the two sections of dike are approximately 860 and 880 feet long with a concrete wall between each section about 480 feet long. At the north end of the project west of Mechanic Street, the dike section is about 60 feet long and extends from the end of a concrete wall between two residential properties to the New York, New Haven and Hartford Railroad embankment. At the south vehicular gate two short sections of dike, 40 feet on the east side and 75 feet long on the west side extend from the gate abutments to high ground.

The dikes, composed of compacted impervious fill, have a top width of 12 feet and side slopes of 2 horizontal to 1 vertical. The river side slope is faced with stone protection 2 feet thick placed upon 2 feet of gravel bedding. On the land side, the slopes are topsoiled and seeded. A toe drain consisting of a 12-inch perforated bituminous coated corrugated metal pipe; 12 inches of filter sand and 24 inches of filter stone, is provided at the land side toe of the dike, beginning about 400 feet from the southerly end of the dike and extending north for the entire length of dike along the river. All dikes have been constructed to a minimum top elevation of 17 feet above mean sea level. Details of the dike sections are shown on Sheets 4, 5, and 6 in Appendix F.

20. MAINTENANCE

a. Paragraph 208.10(b)(1) of the prescribed regulations gives rules for the maintenance of levees. These rules apply equally to earth dikes, and applicable portions are quoted below. Following this are a few of the points that apply particularly to the Pawcatuck project.

"Levees - (1) Maintenance - The superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing of animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Periodic inspections shall be

made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might effect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) _____ Not applicable _____

(ix) _____ Not applicable _____

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency."

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible

care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

b. Any unusual settlement, sloughing or caving should be corrected to restore the original dike grades. No major work shall be made without prior approval of the Division Engineer, in order that such repairs that may be necessary will not adversely affect the functioning of the protective facilities.

c. Inspections of dike shall be made immediately after periods of high water, as it is at such times that any weak spots will be discovered that might otherwise be overlooked.

21. OPERATION

a. Paragraph 208.10(b)(2) of the prescribed regulations gives rules for the operation of levees. These rules apply equally to earth dikes and have been modified for conditions of tidal flooding. The Pawcatuck project will experience tidal flooding that will occur suddenly and for short periods, which during time of peak surge will last for one-hour duration. During periods of peak surges, weather conditions will be of such proportion so as to endanger life and for this reason no patrolling of dikes, or other related works should be permitted. Actual inspections will be accomplished immediately following the recession of the hurricane tidal surge. Following are a few points which apply particularly to the Pawcatuck project.

Operation - After flood periods the dike shall be patrolled to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

- (1) There are no indications of slides or sloughs developing;
- (2) Wave wash or scouring action has not occurred;
- (3) No low reaches of levee exist which may be overtopped;
- (4) No other conditions exist which might endanger the structure.

Appropriate measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

b. Patrolling the dike depends on the depth of water against the river side slope of the dike which can be determined by staff gage readings or by hurricane conditions. Personnel should not be patrolling dikes during periods of high winds or during a hurricane attack. Stages in this manual refer to staff gages which are marked to read from mean sea level up to an elevation of 17 feet above mean sea level. Staff gages are located as follows:

From mean sea level to 6 feet above mean sea level - on the west face of the intake well structure about 60 feet north of the pumping station;

From 6 feet above mean sea level to 17 feet above mean sea level - on the east face (river side) of the concrete wall about two feet north of the pumping station.

(1) Patrolling of the dikes and walls along the river during spring freshet floods or abnormal high tides should stop when the water reaches a stage of 4.0 feet on the staff gage located on the intake well structure.

(2) Personnel should be thoroughly instructed as to their duties, what they are to watch for, and the exact limits of their beat. On each journey of inspection they should carefully examine both slopes of the dike for seepage or wetness on landside slope, sand boils on landside of dike, wave wash or scouring on riverside slope, indications of slides or sloughs on either slope, and any other existing conditions which may endanger the structure.

22. EMERGENCY REPAIR MEASURES

a. Scours. - Careful watch should be maintained over stretches of the dike where scouring is likely to occur, particularly at curves in the alignment where the dike is subject to heavy currents. If any indication of scouring is observed, soundings should be taken to observe the amount and progress of the scour. Sandbagging or dumped rock will generally afford the most practicable means of combatting this condition. The open ends of sandbags so used must be sewed or tied after filling with earth. This work is to be accomplished immediately following a hurricane.

b. Wave Wash. - Dikes may be subjected to wave wash on broad reaches of water even though the direct action of high wind is impeded by natural barriers such as trees. Wave action may cause

undermining of riprap and wash-out of earth materials on the river side slope of the dike. Extent of washes can be observed by sounding along the attacked slope. Sandbags should be placed in the eroded sections in as effective a manner as possible, carrying the protection well above the action of the waves. Sandbags used for this purpose should be sewed or tied, in order to obtain a maximum of coverage with only sufficient weight to hold the sack in place.

c. Sand Boils. -

(1) General - A sand boil is the result of a transfer of pressure head and seepage from the river through a pervious stratum near or at the surface to the landside of the levee. This seepage under pressure tends to push its way to the surface and actually floats the material through which it flows. No harmful effect results provided the weight of the relatively impervious soil layer overlying the pervious stratum, in which the flow under pressure is occurring, is sufficient to counterbalance this pressure. When the soil stratum overlying the pervious layer is insufficient to counterbalance the upward pressure or when no such stratum exists, boils break through the surface on the landside wherever these weaknesses are present. The sand boil may discharge relatively clear water or the discharge may contain quantities of sand and silt, depending upon the magnitude of the pressure and the size of the boil.

(2) Effects of Sand Boils. - Sand boils can produce three distinctly different effects on the levee, depending upon the conditions of flow under the levee. These three effects are illustrated in Appendix E. In Figure 1, Plate No. I, the seepage flow develops a definite pipe or tube under the levee. This breaks out at the landside toe in the form of one or more large sand boils. Unless checked, this flow causes a cavern to be developed under the levee, resulting in subsidence of the levee and subsequent overtopping. This case can be most easily recognized by slumping of the levee crown. Figure 2, Plate No. I, illustrates the case where seepage flows under pressure under the levee without following a defined path, as was the case above. This flow results in one or more boils outcropping at or near the landside toe. The flow from these boils tends to undercut and ravel the slope, resulting in a sloughing of the slope. Evidence of this type of failure is found in undercutting and ravelling at the landside toe. Figure 3, Plate No. I, shows a third type of effect of a sand boil. In this case, numerous small boils, many of which are scarcely noticeable, outcrop at or near the toe. While no boil may appear to be dangerous in itself, the consequence of the group of boils is to cause flotation of the soil, thereby reducing the shearing strength of the material at the toe, where maximum shearing stress occurs, to such an extent that failure of the slope through sliding results.

(3) General Instructions for Handling Sand Boils - All sand boils shall be watched closely. All boils shall be marked conspicuously with flagging so that they can be located without difficulty and observed for changes in their condition. A sand boil which discharges clear water in a steady flow is usually not dangerous to the safety of the levee. The only action necessary in this case is to drain the excess water off to prevent it from standing near the levee. However, if the flow of water increases, and the sand boil begins to discharge material, corrective action shall be undertaken. All work should be accomplished as soon as weather conditions permit.

(4) Method of Treatment. -

(a) The accepted method of treating sand boils is to construct a ring of sand bags around the boil, building up a head of water within the ring sufficient to prevent further movement of sand and silt. The accepted method of ringing a sand boil, shown on Plate No. II of Appendix E, is as follows:

1. The entire base of the sack ring is cleared of debris, in order to provide a watertight bond between the natural ground and the sack ring.

2. The sacks are then laid in a ring around the boil with joints staggered, and with loose earth between all sacks.

3. The ring is carried only to a height sufficient to prevent material from being discharged. The ring should not entirely stop the flow of water, because of the probability of the excessive local pressure head causing additional ruptures of impervious strata and boils nearby.

4. A "V" shaped drain constructed of two boards, or a piece of sheet metal, is then placed near the top of the ring to carry off the water.

(b) Actual conditions at each sand boil will determine the exact dimensions of the ring. The diameter and height of the ring depend upon the size of the boil, and the flow of water from it. In general, the following considerations should govern:

1. The base width should be no less than $1\frac{1}{2}$ times the contemplated height.

2. It is well to include weak ground near the boil within the ring, thereby preventing a break through later.

3. The ring should be of sufficient size to permit sacking operations to keep ahead of the flow of water.

(c) Where many boils are found to exist in a given area, a ring levee of sandbags shall be constructed around the entire area and, if necessary, water pumped into the area to provide sufficient weight to counterbalance the upward pressure.

d. Sloughs. - During high water stages, seeping and sloughing conditions as on the back slopes may occur. Such conditions should be observed closely as to progress of seepage up the back slope and the amount of material that is being carried by the water. If the seep velocity becomes great enough to cause, or probably cause, erosion or sloughing of the slope, a sandbag covering should be placed on the seeping area, beginning well out from the toe and progressing up the slope. The covering should extend several feet beyond the saturated area. If the material is obtainable, the affected area should be covered with brush, straw or similar permeable material to a depth of two to four inches before placing the sandbag cover. This will permit the seep water to get away while serving as a filter to prevent loss of earth from the dike. After the covering is placed, close observation should be maintained and additional layers of sandbags placed on the previous ones until the velocity of the seepage is reduced to a point at which the amount of material carried is negligible. Sacking sloughs are illustrated on Plate No. III of Appendix E. Corrective work, as outlined above, is to be accomplished immediately following hurricane periods and is to act as a temporary repair until permanent repairs can be performed.

e. Raising Existing Earth Dikes. - The grade of a dike can be safely raised three feet. The methods most commonly used for this purpose are outlined in the following paragraphs. Such work, however, can be accomplished only after hurricane periods, and is of temporary nature until time permits a permanent restoration.

(1) Sandbag Topping. - The sack ordinarily used for topping an earth dike is a grain or feed sack which holds 100 pounds. Smaller sacks may be used if feed sacks are not available. Grain sacks, filled with about one cubic foot of earth, weighing about 100 pounds, will provide a unit about six inches high, one foot wide and two feet in length.

The sacks may be filled at the source of material and hauled to the dike or filled from stockpile or borrow areas at the dike, conditions determining the method employed. The same is true of filling; i.e., whether power or hand methods are used. The open end of the sacks should always face upstream or toward the riverside of the dike and need not be sewed or tied. When the sack faces the river the loose end should be folded under and when facing upstream the loose end covered by the succeeding sack.

The front line of sandbags in the first layer should be laid parallel to the dike centerline and remaining bags at right angles to the centerline. The sandbags in the second layer are all laid at right angles to the centerline, the third row similar to the first, etc., as shown on Plate No. IV of Appendix E. All sacks should be lapped about 1/3 each way and well mauled or tramped into place. The sacks should be filled to 2/3 their capacity when flattened out to facilitate proper placing and prevent bursting the sack when mauled or tramped into place.

Plate No. IV illustrates the progressive method of increasing the dike height and gives an approximation of the number of sacks required for dikes of various heights. Plate No. V shows pictures of model sack dike or topping.

A crew of 50 men should fill, carry and place approximately 1500 sacks per eight-hour day, all hand labor, when the source of material is within 150 feet of the point of placement. Production will depend on conditions at the site.

(2) Lumber and Sandbag topping - is the most satisfactory method of raising low reaches of earth dike in emergencies. The chief objection is the time required to install. In putting on this topping, as well as any other topping, a careful line of levels should be run and grade stakes set in advance unless the dike top follows a dependable grade-line. Two-by-four or two-by-six inch stakes should then be driven on the riverside of the crown six feet apart and one-by-twelve inch boards nailed to landside of the stakes. This wall, backed with a single tier of sandbags, will hold out at least one foot of water. If the second foot is necessary, the layers of bags will have to be increased in number and reinforced. Sandbags are laid substantially in the manner described in (1) above. The stakes should be driven at least three feet into the ground, leaving at least three feet out, which will, in extreme cases, hold a three-foot topping if properly braced behind with sandbags. Plate No. VI, Appendix E illustrates this method of raising a dike.

SECTION VI

FLOOD WALLS

23. DESCRIPTION

As indicated on sheets No. 2 and 3, three sections of concrete T-wall have been constructed. One length of wall about 480 feet long is located along the west bank of the Pawcatuck River between the two sections of earth dikes. A second section of T-wall about 300 feet long extends from the north end of the dike to the easterly side of Mechanic Street and to the north vehicular gate structure. A third section of T-wall about 160 feet long extends from the west side of the north vehicular gate structure between two residential properties to the new dike at the railroad embankment. The T-walls composed of concrete and steel reinforcement have a wall and base slab thickness of 18-inches minimum and a top elevation of 17 feet above mean sea level. The bottom elevations and width of T-wall base slabs vary.

The river side of the T-wall section along the west bank of the river has a gravel and random fill berm constructed to elevation 5.5 feet above mean sea level. The dike berm which has a top width of 14 feet and a side slope of 2 horizontal to 1 vertical, is faced with stone slope protection 2 feet thick placed on 2 feet of gravel bedding. The land side of the T-wall is backfilled with random fill to an approximate elevation of 5.5 feet above mean sea level. The other two sections of T-wall are backfilled with random fill on both sides of the wall to an elevation that varies to meet the existing grades.

A toe drain consisting of a 12-inch perforated bituminous coated corrugated metal pipe, 12 inches of filter sand and a varying amount of filter stone is provided at the land side of the T-wall section along the west bank of the river, and also at part of the T-wall section located at the north end of the dike. Details of the walls and toe drains are shown on the drawings in Appendix F.

24. MAINTENANCE

Paragraph 208.10(c)(1) of the prescribed regulations gives rules for the maintenance of flood walls. Applicable portions of these rules are quoted below.

"(c) Flood Walls - (1) Maintenance - Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of floods;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and affect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in engineering practice."

25. OPERATION

a. Paragraph 208.10(c)(2) of the prescribed regulations gives rules pertaining to flood walls during periods of flood emergency. These rules are quoted below. Following these, a few of the points which apply particularly to the Pawcatuck, Connecticut project will be discussed.

b. Operation - Patrol of the wall shall be performed following flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plants or boats will not be allowed to lie against or tie up to the wall. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

c. Patrolling of the wall depends on the depth of water on the river side of the wall which can be determined by staff gage readings or by hurricane conditions. For location of staff gages, refer to Section V, Paragraph 21b.

(1) Patrolling of the walls and dikes along the river during spring freshet floods or abnormal high tides should stop when the water reaches a stage of 4.0 feet on the staff gage located on the intake well structure.

(2) During hurricane threats, patrolling of the walls and dikes on the entire flood control project should stop when conditions indicate the possibility of dangerous flood heights.

(3) Patrolmen should be thoroughly instructed as to their duties, what they are to watch for, and the exact limits of their beat. They should carefully examine for seepage, wetness or sand boils on land side of walls, wave wash or scouring on river side of walls and any other existing conditions which may endanger the structure.

26. EMERGENCY REPAIR AND MEASURES

The superintendent or responsible members of his organization shall take immediate action to correct any condition which endangers the stability of the wall. All such measures taken will be reported to the Division Engineer immediately after the flood period.

(1) Scours, wave wash and sand boils - See Section V, Paragraphs 22a, b, and c for measures to be taken in the event scours, wave wash or sand boils develop.

(2) Raising grade of wall - The walls may be raised temporarily by a single row of sandbags or by lumber topping (shown on Plate No. VII of Appendix D) with riverside stakes driven immediately behind the wall.

SECTION VII

DRAINAGE STRUCTURES

27. DESCRIPTION

A collector drain line has been installed on the landward side of the dikes and T-wall which will conduct surface drainage from rainfall and seepage through dikes and walls to the pumping station. The drain will also intercept all existing sanitary sewers, storm drains, and other industrial waste lines which hereto-fore emptied into the river. Seepage water will be intercepted and controlled by toe drain lines that have been connected to the main storm drain collector. During normal periods, all storm, sewer, waste and interceptor lines operate under gravity to and through the inlet chamber of the pumping station, and thence to the discharge line into the river.

The interceptor, constructed of reinforced concrete pipe, varies in size from 12-inches to 36-inches in diameter, Class III and V. Approximately 21 drain manholes have also been installed along the drain line and at the intersection of other pipe lines. Invert elevations, location of drain lines, and construction details are shown on the drawings in Appendix F.

28. MAINTENANCE

Paragraph 208.10(d)(1) of the prescribed regulations gives rules for the maintenance of drainage structures. These rules, quoted below, are self-explanatory and require no amplification with regard to the Pawcatuck, Connecticut project.

"(d) Drainage structures - (1) Maintenance - Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections."

29. OPERATION

a. Paragraph 208.10(d)(2) of the prescribed regulations gives rules for operation of drainage structures. Following are a few of the points which apply particularly to the Pawcatuck, Connecticut project.

b. As soon as "hurricane warnings" are issued, all drainage gates will be inspected and any object which might prevent closure of the gates shall be removed. Toe drain lines will be inspected by way of observation risers for any obstructions in the pipe line. Storm drain manholes shall also be inspected for sedimentations and obstructions which may interfere with interior drainage flows. Immediate steps shall be taken to correct any adverse condition.

c. During hurricanes and high river stages, the 48-inch sluice gate at the entrance of the wet well of the pumping station, will be opened, thus collecting all drainage flow from behind the dike into the wet well, and the sluice gate which normally allows the drainage to flow by gravity into the river will be closed. The total flow, composed of surface runoff, infiltration, sewage and industrial wastes will then be pumped into the river.

In the event of a severe rainstorm without an abnormally high tide, the pumps will remain out of operation, the wet well will be by-passed and the entire flow will go into the river by gravity.

SECTION VIII

VEHICULAR GATES - NORTH AND SOUTH

30. DESCRIPTION

Two miter-type steel swing gates have been constructed on Mechanic Street as part of the flood control protection. The two vehicular gates which are required to close off Mechanic Street are nearly the same in dimension and in design. The clear opening of the gates is 44 feet with the top of the gates at elevation 17.0, and top of the concrete gate abutments at elevation 18.0. The gates are normally stored into the concrete abutments when not in use. In a closed or operating position the gates have a base angle of 34 degrees with the horizontal. The requirement for closing gates with a minimum warning period and possibly during high winds, make it desirable to have an assembled gate, necessitating a minimum closing time. Sand bags will be used at the bottom of the gates on the river side to seal off space between the bottom of gates and surface of roadway. When in storage the gates are locked into the abutment cavities by means of bolts attached to clip angles set into concrete abutment and by a fixed jack which is also utilized in the maintenance of gate hinges or other gate repairs. Construction details are shown on the drawings in Appendix F.

31. MAINTENANCE

a. Paragraph 208.10(e)(1) of the prescribed regulations gives rules for the maintenance of closure structures. These rules apply equally to the vehicular gates and applicable portions are quoted below. Following this a few of the points that apply particularly to the Pawcatuck, Connecticut project are discussed.

"(e) Closure Structures - (1) Maintenance - Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

- (i) No parts are missing;
- (ii) Metal parts are adequately covered with paint.
- (iii) All movable parts are in satisfactory working condition.
- (iv) Proper closure can be made promptly when necessary.
- (v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible at times of emergency.

b. Trial closure of structures shall be made at least once a year, and whenever a change is made in key operating personnel. Trial erection of sand bag closures is not required. Closure materials will be checked prior to and following flood periods. Damaged or missing parts shall be repaired and or replaced immediately.

32. OPERATION

The two gates across Mechanic Street are an integral part of the protective works along the Pawcatuck River. Closure of each movable gate shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring.

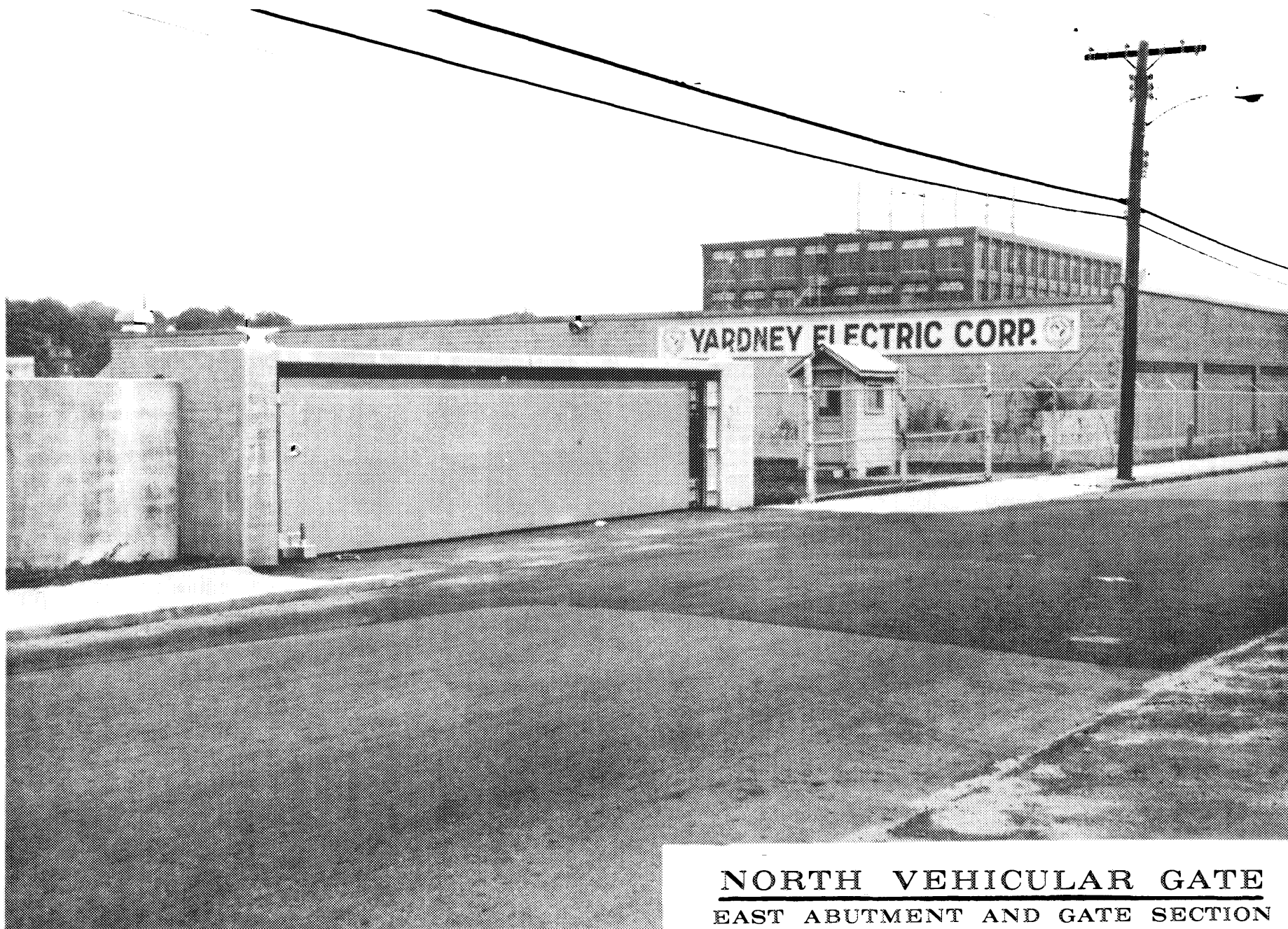
a. Timing of the closure of these openings should be related to the height of water on the staff gages, refer to Section V, Paragraph 21 b. The zero on the staff gage is at elevation 0.0 msl. When the water reading on this gage is at +5.0 feet msl vehicular gates will be closed. Earlier closing may be necessary if increasing wind velocities and rainfall will make closure difficult if delayed.

b. Warning should be given to the police and fire departments that these two gates will be closed to traffic for the duration of the flood. After the flood has subsided the police and fire departments should be notified that the gates are open for traffic. Warning signs to detour around these gates should be set up. Signs to read, "FLOOD GATES CLOSED - DETOUR" (with an arrow pointing in direction of travel).

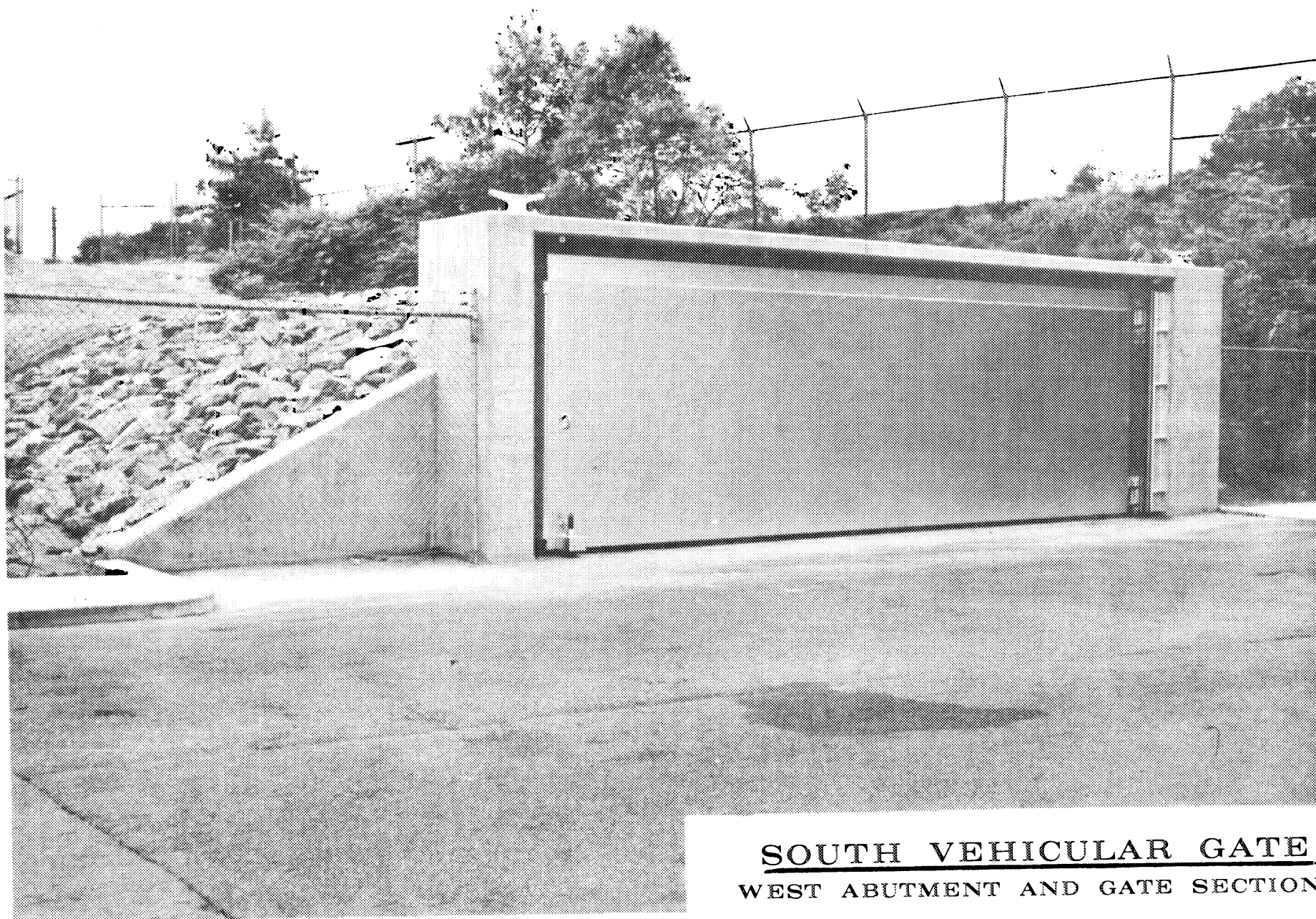
c. When the emergency crew is assembled they should immediately take steps to start closing the gate. First, to clean any obstructions out of highway; second, to fill sand bags from storage box; third, close the gate and place sand bags at the bottom of the gates. When the flood has subsided, this procedure would be reversed and the sand bags emptied and placed in storage after being dried out. A bin for the storage of sand should be provided in a location handy to the gate structures. Sand bags should be stored separately and kept dry.

d. In closing the vehicular gate the first step will involve the unlocking of padlocks and removing chain which locks gate to the gate abutment wall, and the loosening of the bolts which fix the gate to the concrete abutments. These bolts are located at the mitre end of the gate. Subsequently, the gate jack which also acts as a lock, must be released. In the event that high winds are experienced, provisions have been made to place guide ropes through eyelets provided on the

gate, and ship cleats located at the top of the gate abutments. The ropes should be stored in the pump station. A gate stop has been constructed in the center of the roadway which will keep gate sections from bypassing the desired location for the locking operation. Additional information on the procedure for closing vehicular gates may be found in Appendix C.



NORTH VEHICULAR GATE
EAST ABUTMENT AND GATE SECTION



SOUTH VEHICULAR GATE
WEST ABUTMENT AND GATE SECTION

SECTION IX

PUMPING STATION

33. DESCRIPTION

The pumping station is located adjacent to the concrete flood wall along the west bank of the Pawcatuck River in the southeast corner of the Yardney Electric Company's property. It is to be used during tidal flood periods to pump interior drainage waters which will pond to the rear of protection, into the Pawcatuck River. The pumping station has a substructure of reinforced concrete and superstructure of structural steel and brick on reinforced concrete. The station is provided with sufficient capacity to discharge the maximum design runoff based on the existing developments in the drainage area. The pumps are driven by diesel engines directly connected through flexible couplings to right angle gear units which transmit the power through a set of spiral bevel gears to the pump shaft. Details of the pumping station are shown on drawings in Appendix F.

34. PUMPING STATION EQUIPMENT

a. The pumping station contains two, 20-inch vertical, single stage, axial flow type pumps designed to handle storm water and sewage flows. A swing type check valve is provided in the discharge line of each pump to facilitate starting and prevent backflow through the pump. The engines are radiator-cooled, with exhausts cooling the air from the engine room, through the louver, to the outdoors. A sump pump is provided to dewater the sump for maintenance, or repair purposes.

b. Two electrically-operated sluice gates (which in the event of power failure can be manually operated) are provided to divert the normal gravity flow into the station whenever high water or hurricane tides impend. At such periods the 48-inch by 48-inch sluice gate which normally allows the drainage to flow into the river will be closed to prevent backup of tidal waters. The drainage waters collected in the wet well of the pumping station will be pumped into the river. Stoplogs are provided to allow for maintenance or repair work on the sluice gates or substructure of the station. Stoplogs, when not in use, should be stored where they can be kept dry and convenient to their place of use.

c. Electricity for lighting the station is provided through an underground conduit from an electrical distribution panel within the Yardney Electric Company's Building No. 2.

d. A traveling crane with a two-ton capacity has been provided for repair work on the engines or pumps. This crane is geared for hand operation of the bridge travel, trolley travel and hoist lift.

35. MAINTENANCE

a. The following quotations from the regulations govern the maintenance of the pumping stations:

"Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning the building and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machine fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. Records shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable."

b. To help carry out the above quoted regulations the Division Engineer recommends the following:

(1) General - Proper maintenance of the pumping stations requires periodic operation of all equipment at frequent intervals to keep equipment in good working order and all parts well lubricated and free from corrosion. Periodic operation of equipment also permits an inspection of the functioning of all equipment so that

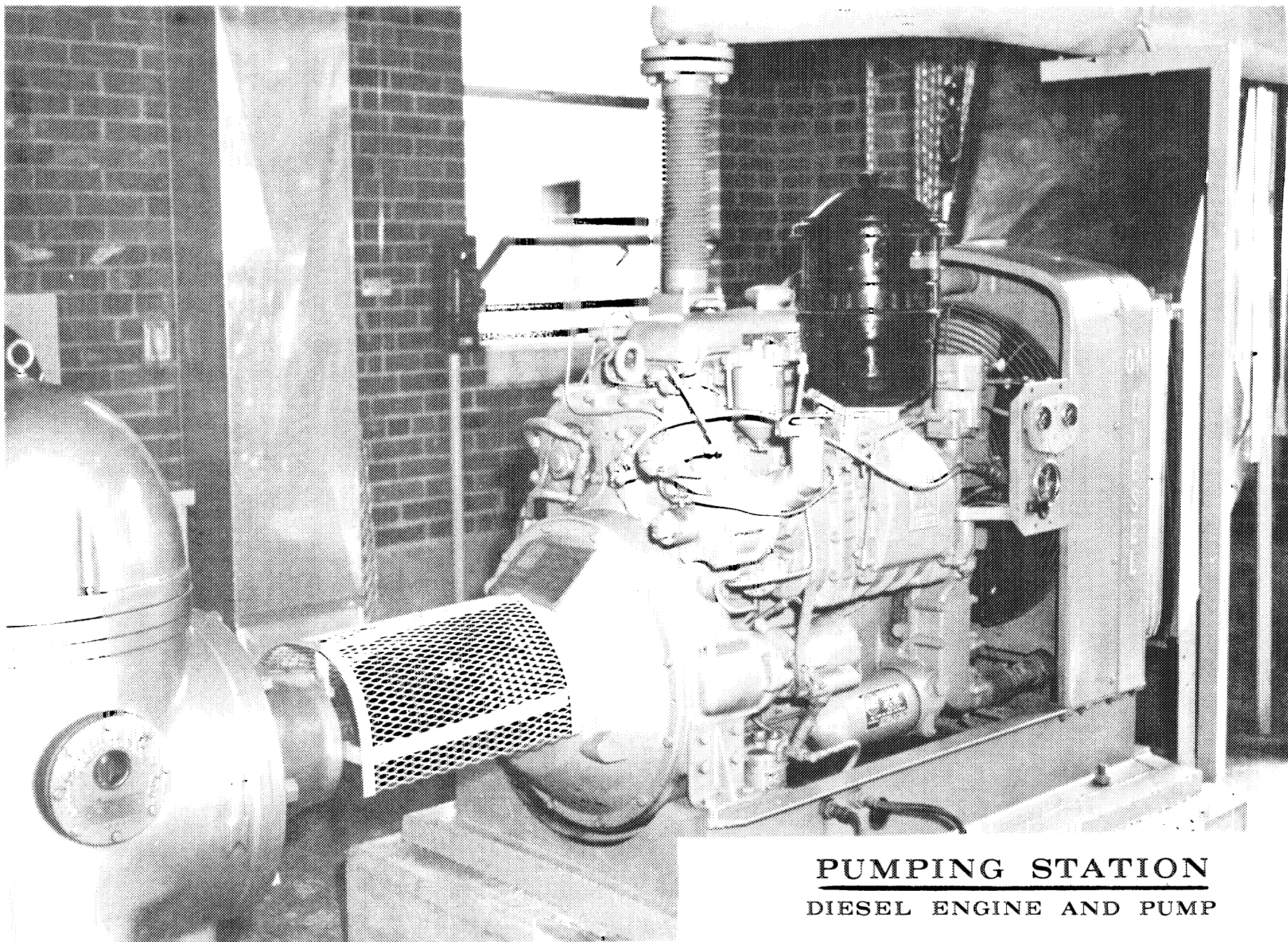
defective parts may be properly replaced or repaired before their use is required for pumping operations. Inasmuch as mechanical and electrical equipment deteriorates more rapidly from idleness than from continuous use, a thorough and complete maintenance routine is justified.

(2) Instruction Manuals - Information given in instruction manuals provided by manufactures of the equipment should be read carefully and operation and maintenance or repairs as suggested should be followed. Two complete sets of manuals have been given the Town, and one set should be kept by the Superintendent.

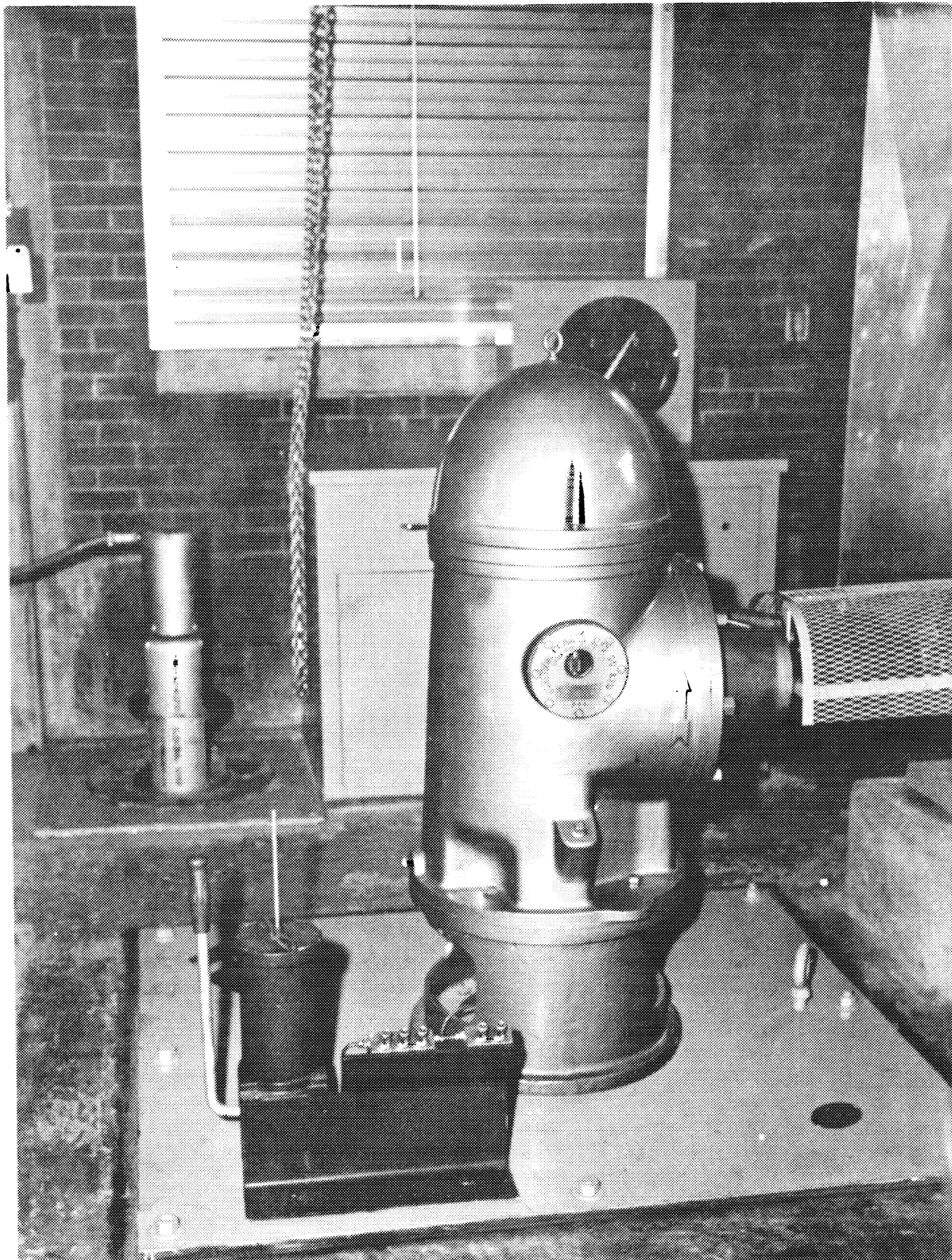
36. OPERATION

During the "hurricane season" which for the Pawcatuck area is from 1 May to 1 November, competent operators shall be on duty at pumping stations when it appears that necessity for pump operation is imminent. The operator shall be familiar with the equipment manufacturer's drawings and with the contents of Appendix C - "Standard Operating Procedure During Flood Periods."

The equipment shall be operated in accordance with the "manufacturer's operating instructions" and care shall be exercised that proper lubrication is being supplied to all equipment, and that no overheating, undue vibration, or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pumphouse sumps flushed out and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept in the station, a copy of which shall be furnished the Division Engineer following each flood. The operation of the pumping station is completely outlined in Appendix C.



PUMPING STATION
DIESEL ENGINE AND PUMP



PUMPING STATION

20-INCH VERTICAL AXIAL FLOW TYPE PUMP

SECTION X

MISCELLANEOUS FACILITIES

37. DESCRIPTION

a. Intake Wells. - Two fire water intake wells have been constructed adjacent to the flood dike. The intake well opposite Station 10+23+ has a 12-inch and 14-inch cast iron pipe suction lines running into the Cottrell Company Building No. 6. The intake well opposite Station 13+36+ has been constructed with one 12-inch cast iron suction line running into the Yardney Company Building No. 2.

Intake structures are constructed of reinforced concrete with timber stoplogs to permit maintenance, and trash screens to keep out debris. These screens are interchangeable with timber stoplogs. Foot valves have been installed on the outboard or suction end of the pipelines. A post indicator valve extended to the top of the dike has been installed on the fire line to the Yardney Building. Cast iron gate valve boxes have been installed at the roadway level for control of the two fire lines into the Cottrell property. Details for the intake wells are shown on drawings in Appendix F.

b. Seepage Control at Cottrell Company - The plan of protection provides for seepage control in Buildings No. 2 and 5 of the Cottrell Company. Relief drain lines and sumps equipped with automatic motor driven pumps have been installed. The pumps are directly connected by a flexible coupling to a vertical electric motor. The motors are operated by a float switch having two electrodes adjusted to start and stop the motor at predetermined levels. Electric service is tied into existing plant power units which have standby generators. The discharging line from each pump has a check valve to control back flow and a gate valve to completely close the line.

38. MAINTENANCE

Paragraph 208.10(h)(1) of the prescribed regulations gives rules for the maintenance of miscellaneous facilities. These rules apply equally to Intake Structures and applicable portions are quoted below. Following this a few of the points that apply particularly to the Pawcatuck, Connecticut project are discussed.

"(h) Miscellaneous Facilities (1) Maintenance - Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance

measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris or dumped material."

a. Intake Wells. - The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to provide for routine removal of weeds, wild growth, drift deposits, and repair of damage caused by erosion or other forces. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out.

b. Sump Pumps. - Pumps should be oiled, greased and put into operation for several minutes each month by the plant maintenance men of the Cottrell Company. A form should be provided that this work has been done and should be noted by the Project Superintendent. At the beginning of the "hurricane season" and after the season is over the Project Superintendent should operate these pumps, and if any maintenance on motor, pump or piping is required, it should be taken care of immediately.

39. OPERATION

Paragraph 208.10(h)(2) of the prescribed regulations gives rules for the operation of miscellaneous facilities. These rules which are quoted below are self-explanatory and require no amplification with regard to the Pawcatuck, Connecticut project.

"(h) Miscellaneous Facilities (2) Operation - Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the Division Engineer unless designed therefor.

a. Intake Wells - As a hurricane approaches and the probability of flooding appears imminent all fire suction lines will be closed. In the event of a fire simultaneously with a hurricane tide, gate valves of the fire suction lines will be opened manually and as required.

b. Wet-Well Pumps - Sump pumps in Buildings No. 2 and 5 of the Cottrell Company will be utilized as required and operated by personnel of the company.

SECTION XI

DRAWINGS AND SPECIFICATIONS

40. DRAWINGS AND SPECIFICATIONS

A complete set of plans and specifications was furnished the Town of Stonington, and the State of Connecticut at the time of initiation of project construction. A full-sized set of plans showing the project as actually constructed was furnished the Town at the time of transmittal of this manual, reduced prints of these drawings are included in Appendix F.

APPENDIX A

REGULATIONS OF THE
SECRETARY OF THE ARMY

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1838, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 938; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities.*—(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees.*—(1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken; such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls.*—(1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures.*—(1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures.*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order,

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants.*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways.*—(1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities.*—(1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 8 August 1944, CE SPEWF)

[SEAL]

J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 4a-12285; Filed, August 16, 1944;
9:44 a. m.]

APPENDIX B

ASSURANCES OF LOCAL COOPERATION

Assurance of the Town of Stonington, Connecticut

ASSURANCE
OF THE
TOWN OF STONINGTON, CONNECTICUT

WHEREAS, the project for hurricane flood protection at Pawcatuck, Connecticut, is authorized by Act of Congress approved July 14, 1960, Public Law 86-645, substantially in accordance with the plans and recommendations of the Chief of Engineers in House Document No. 212, 86th Congress, 1st Session, to provide for the construction along the west bank of the Pawcatuck River from high ground south of the Cottrell plant to the railroad embankment north of the Yardney Electric Company of the following improvements: an earth fill dike about 1985 feet long; a concrete floodwall about 893 feet long; two vehicular swing gates; and a pumping plant for interior drainage.

WHEREAS, this project within the limits indicated on the foregoing plans can be constructed at a first cost now estimated to be \$780,000.00; and

WHEREAS, the local interests desiring the prosecution of this project are agreeable to give Assurances satisfactory to the Secretary of the Army as set forth in the said House Document.

NOW, THEREFORE, the Town of Stonington, acting by and through its Flood and Erosion Control Board, hereby assures the Secretary of the Army that it will:

(a) provide without cost to the United States all lands, easements, and rights-of-way necessary for construction of the project;

(b) accomplish without cost to the United States all alterations and relocations of buildings, streets, storm drains, and utilities made necessary by reason of the construction;

(c) bear 30 percent of the total first cost, a sum presently estimated at \$234,000 to consist of the items listed in (a) and (b) above and a cash contribution now estimated at \$169,000, the cash to be paid in a lump sum prior to commencement of construction and the final allocation of cost to be made after actual costs and values have been determined;

(d) hold and save the United States free from damages due to the construction works; and

(e) operate and maintain all the works after completion in accordance with regulations prescribed by the Secretary of the Army.

FURTHER, the Town of Stonington does:

Agree that the value of the lands, easements and rights-of-way to be acquired by it shall be determined by an independent appraiser, the selection of whom shall be approved by the Division Engineer, New England Division.

Agree that the appraisal, so obtained, of any lands, easements or rights-of-way to be acquired shall be approved by the Division Engineer, New England Division, or his authorized representative, prior to any negotiation with the owner.

Consent to the entry of a condemnation proceeding in the United States Court for the District of Connecticut in all instances where, on the basis of the approved appraisal, direct purchase by negotiation with owner is unsuccessful.

IN WITNESS WHEREOF, the Town of Stonington, acting by and through its Flood and Erosion Control Board, executed the foregoing Assurance and caused the seal of said Town to be affixed hereto this 22nd day of January, 1962.

TOWN OF STONINGTON
BY ITS FLOOD AND EROSION CONTROL BOARD

Albert J. Graf
Member
James M. Spellman
Member
William H. Line
Member
Edward C. Updegraff
Member
Anthony P. Thompson
Member

ACCEPTANCE

30 January 1962

The within Assurance is hereby accepted for and on behalf of the United States of America.

Seimour A. Potter, Jr.
SEIMOUR A. POTTER, JR.
Brigadier General, USA, Division Engineer

APPENDIX C

STANDARD OPERATING PROCEDURE DURING FLOOD PERIODS

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APPENDIX C

STANDARD OPERATING PROCEDURE DURING FLOOD PERIODS

General

Operation of the Pawcatuck Local Protection Project during flood periods involves closing of fire pump suction lines leading to the Cottrell and Yardney Plants, closing the 48-inch gravity discharge sluice gate and opening the 48-inch sluice gate into the sump in the pumping station, operating the pumps, and closing the vehicular gates on Mechanic Street. A table summarizing the standard operating procedures during a regulation period is attached to this Appendix. Copies of this table should be posted in the pumping station for ready reference.

Responsibilities

The Town of Stonington will be responsible for the operation of the Pawcatuck Project. The U. S. Weather Bureau at Hillsgrove Airport, Rhode Island is responsible for the forecasting of hurricanes and abnormally high tides in the Pawcatuck area. Operating personnel in Stonington will establish a liaison with the Weather Bureau officials in order that they will receive advisories promptly. A report will be prepared following each operation and a copy forwarded to the New England Division.

Regulation During Storms

Case 1. - Hurricane, so identified by U. S. Weather Bureau, is threatening the North Atlantic States. Various phases of operating procedures are described in the following paragraphs.

Phase 1 - Alert. - U. S. Weather Bureau, Corps of Engineers, and the Town of Stonington will be alerted to all hurricanes threatening the North Atlantic States. Both Federal agencies, represented locally by the U. S. Weather Bureau at Hillsgrove Airport, Rhode Island and the New England Division at Waltham, Massachusetts, will closely follow all Weather Bureau advisories and maintain a continuous plot of the storm's position. New England Division will be available for assistance or advice to the Town of Stonington whenever desired. The town will alert all personnel connected with operation of the project.

Phase 2 - Watch. - Hurricane "Watch" announced by U. S. Weather Bureau for southern New England coast. The town will staff the pumping station on a 24-hour basis. Pumps will be tested.

Phase 3 - Warning. - Hurricane "Warning" announced by U. S. Weather Bureau for southern New England coast. Town will:

(1) Mobilize full complement of personnel (to close vehicular gates and perform other duties as required).

(2) Close all fire suction lines. In the event of a fire simultaneously with a hurricane tide, gate valves at the fire suction lines will be opened manually and as required.

Phase 4 - Operations. - Operate sluice gates and pumps as follows:

(1) When tidal surge rises to elevation 2.0 m.s.l. (mean high tide 1.0) open gate into sump of pumping station and close gate on 48-inch drain discharge.

(2) Start one pump and lower water in sump to elevation -3.5. If one pump is not sufficient to lower water surface, start second pump. Thereafter operate in accordance with the following schedule:

<u>Water Elevation in Sump</u>	<u>Pumps</u>	
	<u>No. 1</u>	<u>No. 2</u>
+0.5 Rising	Start	
+1.0 Rising		Start
-3.0 Falling		Stop
-3.5 Falling	Stop	

Speed of pumps will be governed by storm intensity and runoff conditions as indicated by water level in the sump. Pumps will be speeded up when water level rises above 0.0 and slowed down when water level falls below -2.0.

(3) Highway gates will be closed when the gage in the pumping station shows a river rise to elevation +5.0. Earlier closing may be necessary if increasing wind velocities and rainfall make delayed closure difficult.

Phase 5 - Cessation. - When tide recedes below elevation 2.0, open gate on 48-inch discharge, close gate into sump and shut off pumps. Open vehicular gates.

Case 2. - Abnormal Tides from Coastal Storm Other Than Hurricanes -

Phase 1 - Watch. - Weather Bureau announces a coastal storm moving north of latitude 35° (about Cape Hatteras) and posing some possible threat to New England. The town will alert all personnel connected with the operation of the project and will keep posted by U. S. Weather Bureau on movement and possible intensification of storm.

Phase 2 - Warning. - Storm approaches New England and U.S. Weather Bureau forecasts abnormal tides to occur within 12 hours. Town shall prepare as follows:

- (1) Pumping station shall be staffed on a 24-hour basis.
- (2) Pumps shall be tested.
- (3) Close fire suction lines. In case of fire operate as described in Phase 3, Case 1.
- (4) Mobilize complement to stand by vehicular gates. It is not expected that tides will be high enough to warrant closure of gates. Need for such closure shall be based on the anticipated severity of the storm.

Phase 3 - Operations. - Operate sluice gates, pumps and vehicular gates as described in Case 1, Phase 4.

Phase 4 - Cessation. - Operate sluice gates, pumps and vehicular gates as described in Case 1, Phase 5.

Case 3. - Severe Storms without Concurrent Abnormal Tides. - Unless experience indicates otherwise, no operation will be required. Gravity drainage system is adequate to discharge flow from 100-year storm.

Case 4. - Communication Failure or Other Emergencies. - Should communications fail between town and U.S. Weather Bureau or any unexpected conditions arise that are not covered herein, and the exigencies of the conditions require immediate operation of the project, the town shall operate the project in the best and most reasonable manner to satisfy all concerned.

Reports

A report shall be prepared by the operating personnel following each operation requiring closure of gates and use of the pumps. The report shall indicate in chronological order the principal activities of the operation. A tabulation similar to inspection report forms in Appendix D shall be inclosed with the report. During abnormal tide conditions it is essential to log frequent readings of the river stages in order that an evaluation can be made of the effectiveness of the project. The frequency of the readings will depend on the rate of rise or fall in the tide stages.

Operating Personnel

The emergency crew necessary to be organized into a working unit should consist of the following 14 men:

1. A superintendent, who will take charge;
2. An alternate superintendent, preferably a mechanic;
3. Two operators for the pumping station;
4. Six men to close the north and south vehicular gates, post warning signs and lanterns on roadway for detours, and hang red lanterns on the gates. Of these six men, one would be assigned to patrol the area in the vicinity of each of the gates, the other four men would be paired off to patrol the dikes and flood walls;
5. Four additional men would be on call or held in reserve, to assist in patrolling the dikes and gates and to fill sand bags and carry them to wherever necessary, to protect the dike from undermining or from leaks through the dikes.

A pickup truck should be made available to assist in transporting men and material around the inside perimeter of the protected area.

Two portable gasoline driven pumps with capacity of 500 g.p.m. and 20 feet of suction hose and 40 feet of discharge hose should be made available for emergency use, if necessary to pump out areas where sand boils have occurred.

Project Superintendent: _____

Home Address: _____

City and State: _____

Telephone No.: _____

Place of Work: _____

Telephone No.: _____

Alternate Project Superintendent (in case Superintendent can not be reached): _____

Home Address: _____

City and State: _____

Telephone No.: _____

Place of Work: _____

Telephone No.: _____

STANDARD O

<u>Phase No.</u>	<u>Condition</u>	<u>Fire Section Lines</u>	<u>Val</u>
	<u>Normal</u>	Open	
<u>CASE 1 - HURRICANE</u>			
1	<u>Alert</u> Hurricane threatening North Atlantic States	Open	
2	<u>Watch</u> Advisory from USWB	Open	
3	<u>Warning</u> Advisory from USWB	Close. In event of fire simultaneously with hurricane tide, open gate valves manually as required	
4	<u>Operations</u> Tide elevation +2.0, rising	Closed	Close ties & delay cult
5	<u>Operations</u> Tide elevation +5.0	As above	
6	<u>Cessation</u> Tide receding below elevation +2.0	Open gate valves	
<u>CASE 2 - ABNORMAL</u>			
1	<u>Watch</u> Coastal storm posing some possible threat to New England	Open	
2	<u>Warning</u> Storm approaches New England and USWB forecasts abnormal tides to occur within 12 hours	Close. Operate as in Case 1, Phase 3	
3	<u>Operations</u> Tide elevation +2.0, rising	Closed	Need for likely on predicted tide. elevati
4	<u>Cessation</u> Tide receding below elevation +2.0	Open	

APPENDIX D

INSPECTION REPORT FORMS

FLOOD PROTECTION SYSTEM INSPECTION REPORT		LOCATION
DIKE INSPECTION		LOCATION AND DESCRIPTION OF DEFICIENCIES
Grass or Sod		
Caving banks or erosion		
Burrowing animals		
Sand boils		
Stone slope Protection		
Trespassing		
VEHICULAR GATES		
When trial operated		
General condition		
Painting		
Rubber seals		
Concrete walls		
Remarks:		
Date	Inspected by: Typed Name & Title	Signature
Check items if found satisfactory, otherwise list deficiencies.		

FLOOD PROTECTION SYSTEM INSPECTION REPORT		LOCATION
Concrete Wall Inspection		Location and Description of Deficiencies
Wall		
Cracks		
Settlement		
Joints		
Spalling		
Stone Slope Protection		
Water Stops		
INTAKE WELLS		
Concrete		
Trash Racks and Gates		
Foot Valves		
Post Indicator Valves		
RELIEF DRAINS		Cottrell Building No. 2 and No. 5
Concrete Sump		
Sump Pumps		
REMARKS:		
Date	Inspected by: Typed Name & Title	Signature
Check Items if found Satisfactory, otherwise list Deficiencies.		

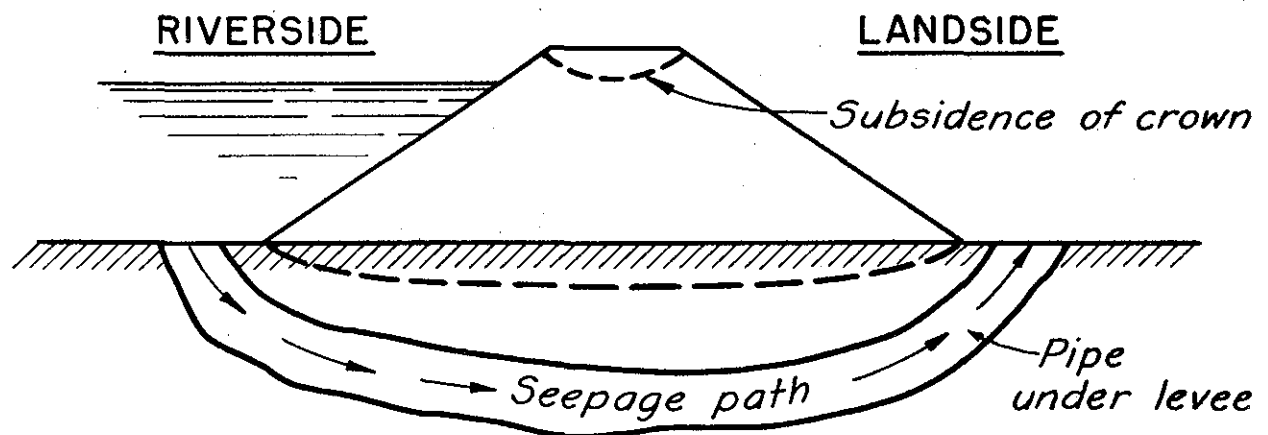
FLOOD PROTECTION SYSTEM INSPECTION REPORT		LOCATION
PUMPING STATION		LOCATION AND DESCRIPTION OF DEFICIENCIES
Substructure		
Walls		
Roof		
Doors - Windows		
Crane and Hoist		
Paint		
Pumps, Motors		
When trial operated		
Lubrication		
Oil Changes		
Air Intakes & exhaust		
Sluice Gates - Flap Valves		
Stop Logs		
GENERAL		
1. Availability of Sand and Sand Bags		
2. Have all deficiencies noted in previous reports been corrected?		
REMARKS		
Date	Inspected by: Typed Name & Title	Signature
Check items if found satisfactory, otherwise list deficiencies.		

APPENDIX E

FLOOD EMERGENCY MEASURES

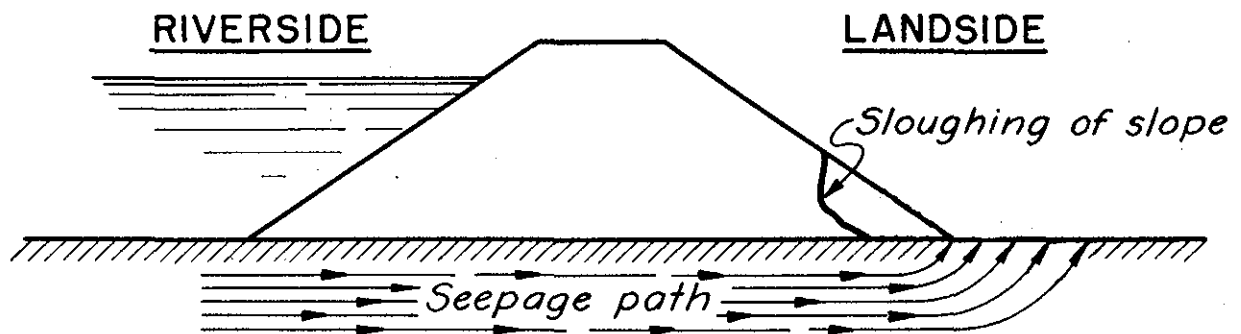
<u>Title</u>	<u>Plate No.</u>
Effect of Sand Boils	I
Sand Boil	II
Sacking Sloughs	III
Sack Dike or Topping	IV
Model Sack Dike or Topping	V
Lumber and Sack Topping	VI
Flashboards	VII

EFFECTS OF SAND BOILS ON LEVEE



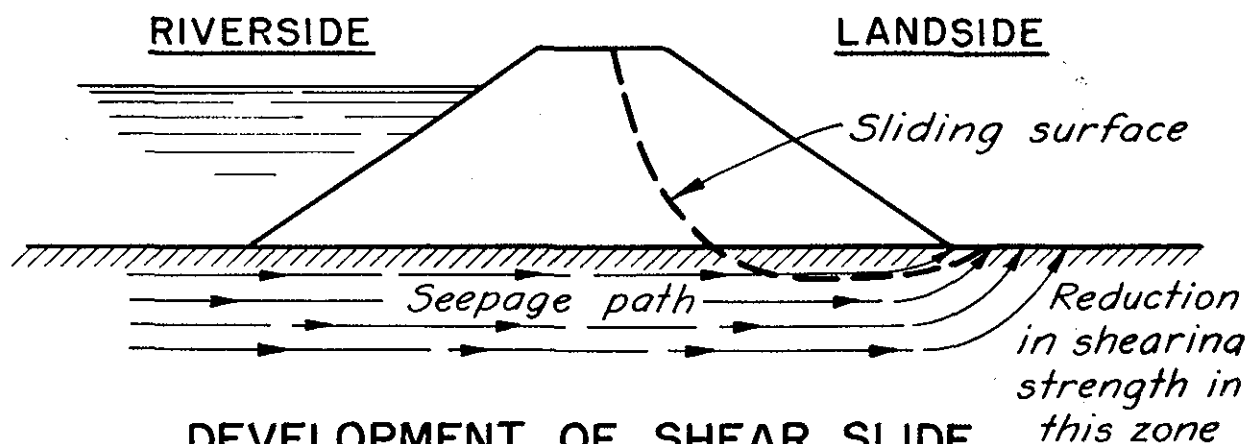
DEVELOPMENT OF PIPE UNDER LEVEE

Fig. 1



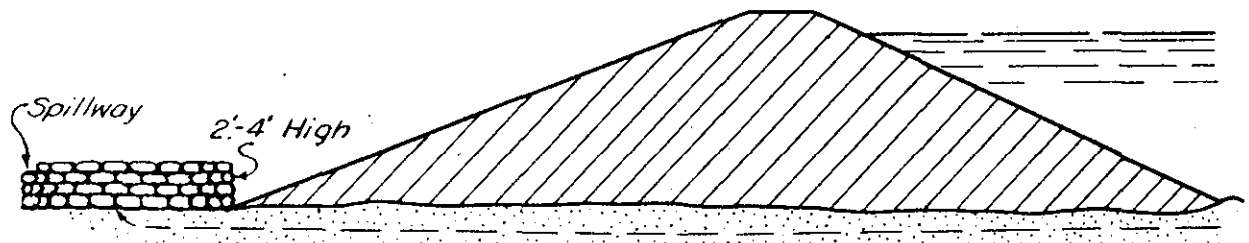
SLOUGHING OF LANDSLIDE SLOPE DUE TO RAVELLING AND UNDERCUTTING OF TOE

Fig. 2

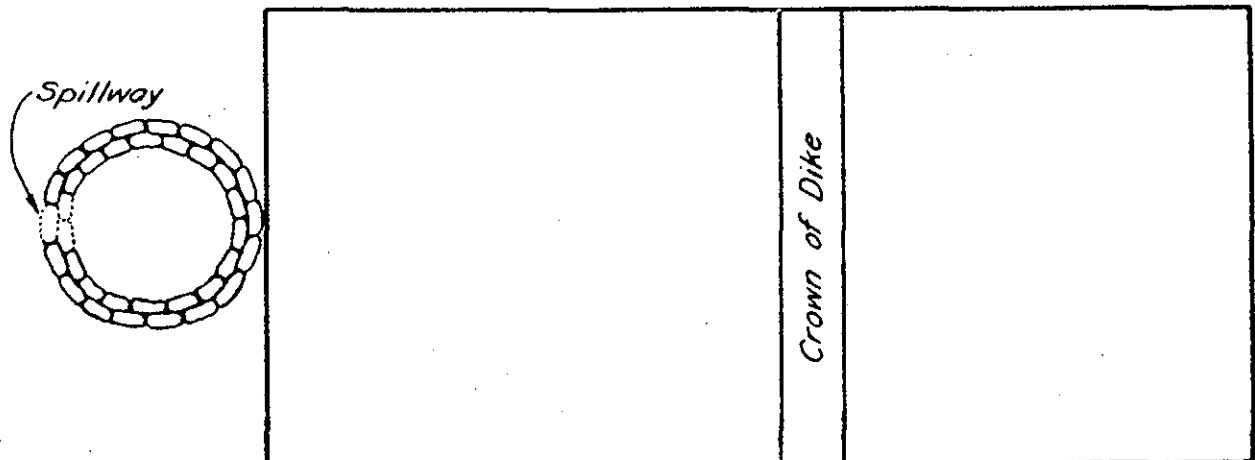


DEVELOPMENT OF SHEAR SLIDE

Fig. 3



Wall should be built on firm ELEVATION foundation, with width of base at least $1\frac{1}{2}$ times the height. Be sure to place sacks on ground clear of sand discharge. Tie into dike if boil is near toe.

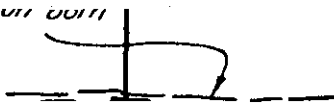


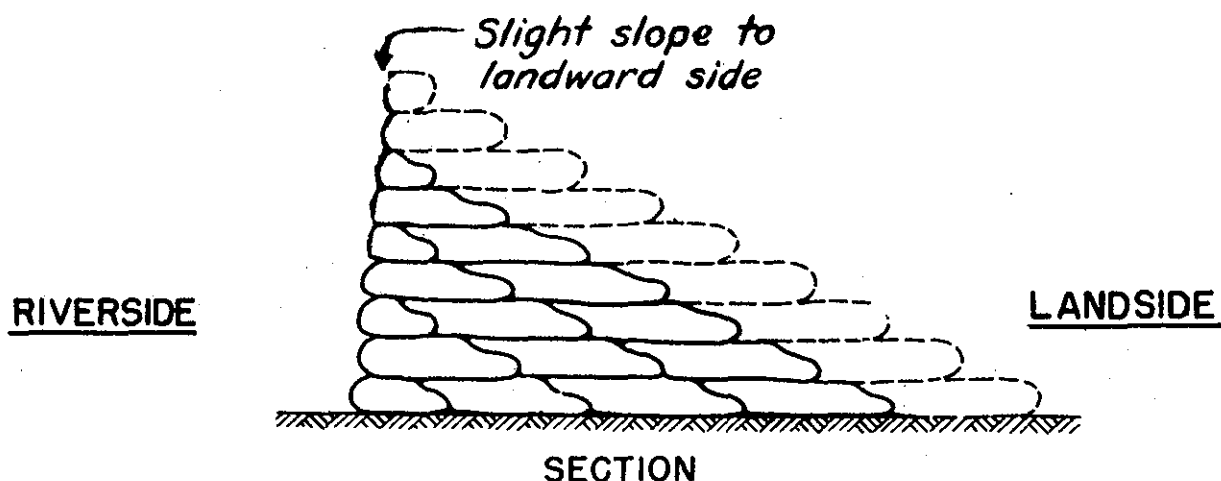
PLAN

Do not sack boil which does not put out material. Height of sack loop or ring should be only sufficient to create enough head to slow down flow through boil so that no more material is displaced and boil runs clear. Do not try to stop fully, flow through boil.

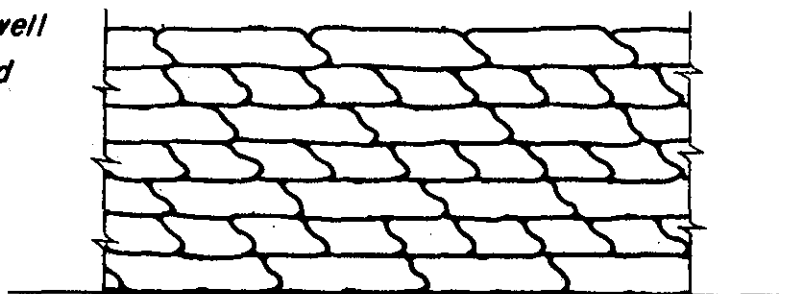
**SAND BOIL
STANDARD HIGH WATER
MAINTENANCE INSTRUCTION**

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.





Note: Sacks should be lapped at least 1/3 all ways and well mauled or tamped into place.

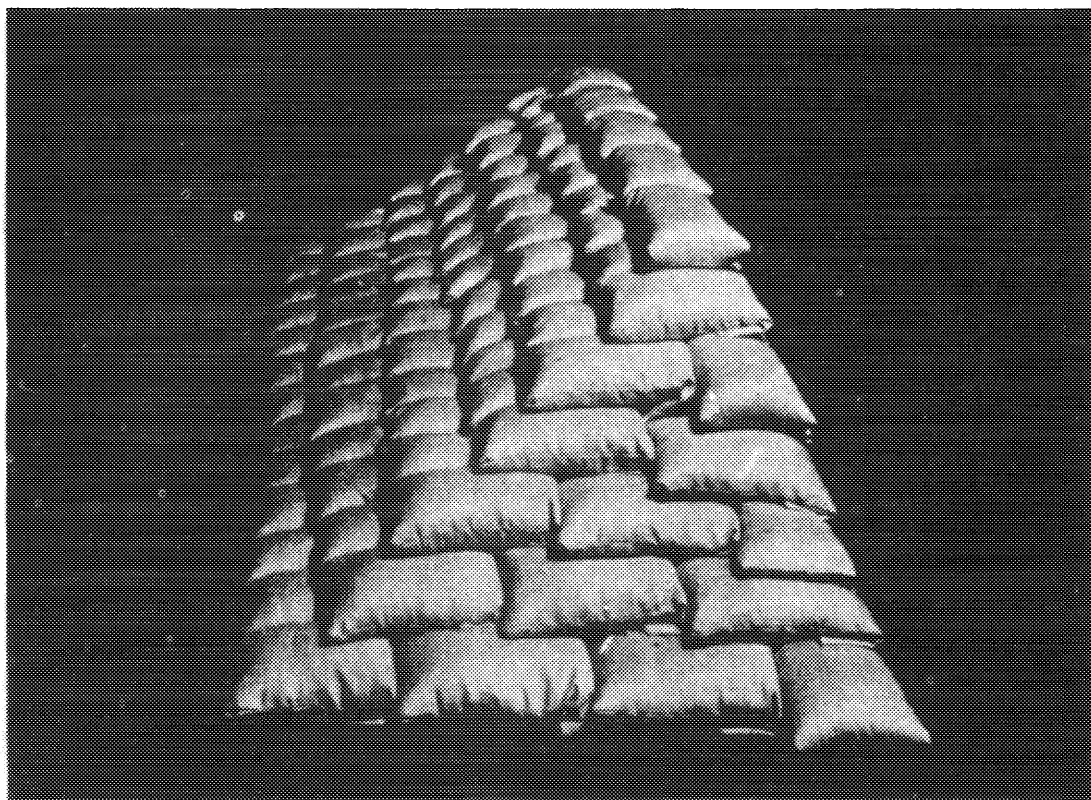


SACKS REQUIRED PER 100' STA.
100 lb. "Feed" Sacks - 1 Cu. Ft. Each

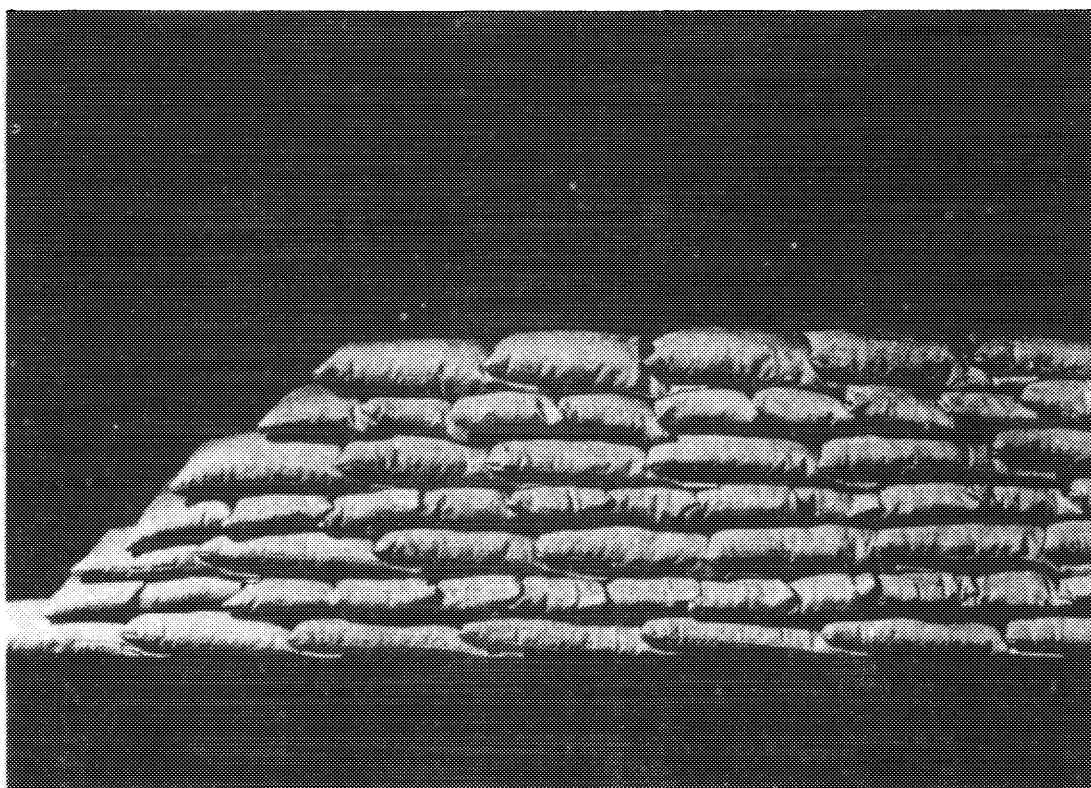
Approx. Hgt. Sack Dike	Sacks High	Required
1.5	3	300
2.0	4	750
3.0	6	1400
4.0	8	2250
5.0	10	3250
6.0	12	4500
7.0	14	5950
8.0	16	7600

SACK DIKE OR TOPPING
STANDARD HIGH WATER
MAINTENANCE INSTRUCTION

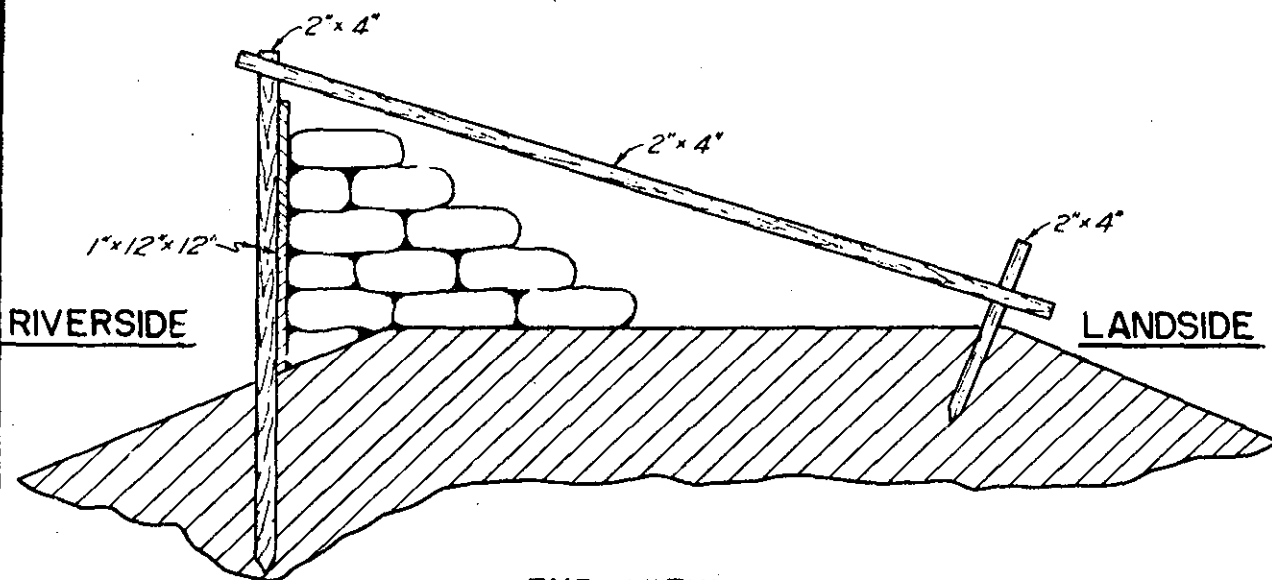
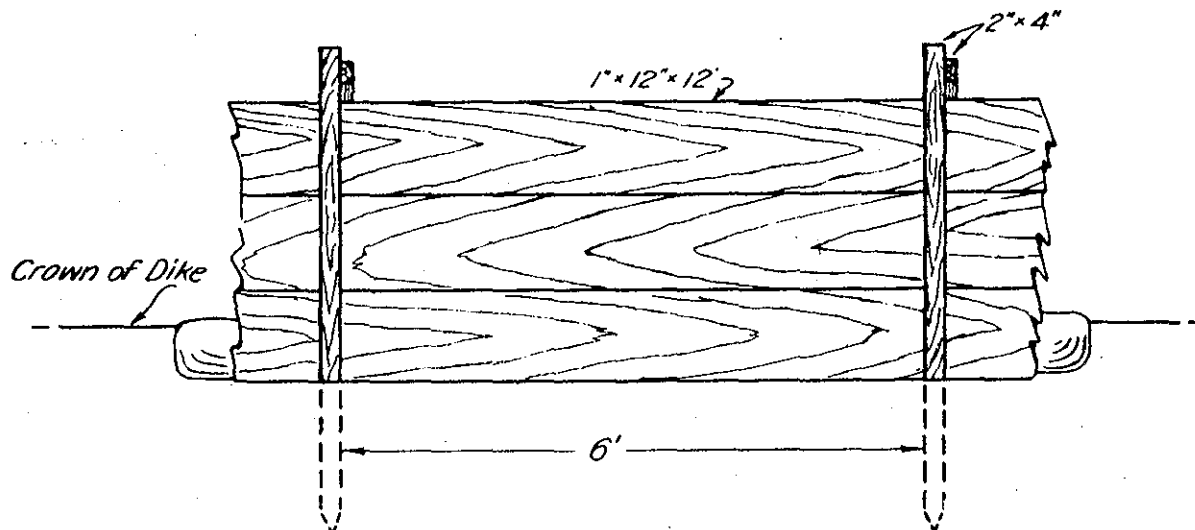
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.



MODEL SACK DIKE OR TOPPING
Typical Section



MODEL SACK DIKE OR TOPPING
Riverside View

END VIEWFRONT ELEVATIONBILL OF MATERIAL TO CONSTRUCT 100 FEET

25 pcs. 1'x12'x12'

17 pcs. 2'x4'x6'

17 pcs. 2'x4'x10'

17 pcs. 2'x4'x2'

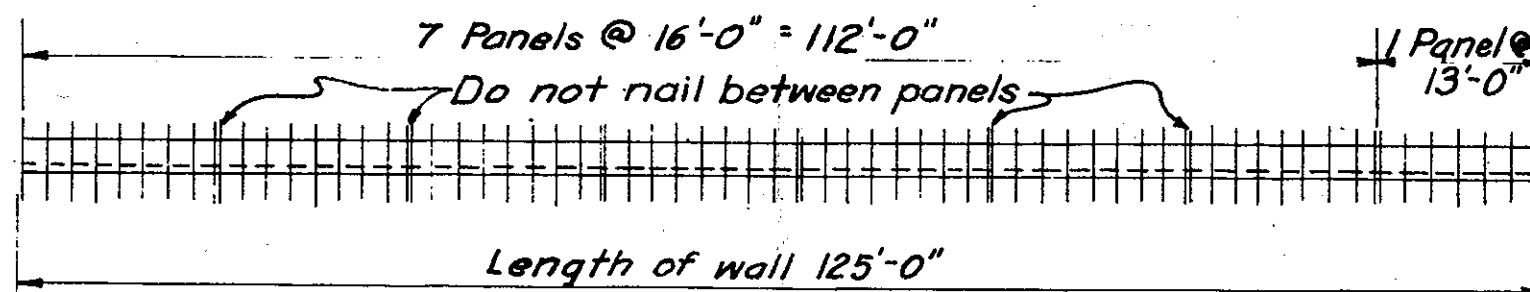
**LUMBER AND SACK TOPPING
STANDARD HIGH WATER
MAINTENANCE INSTRUCTION**

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

APPENDIX F

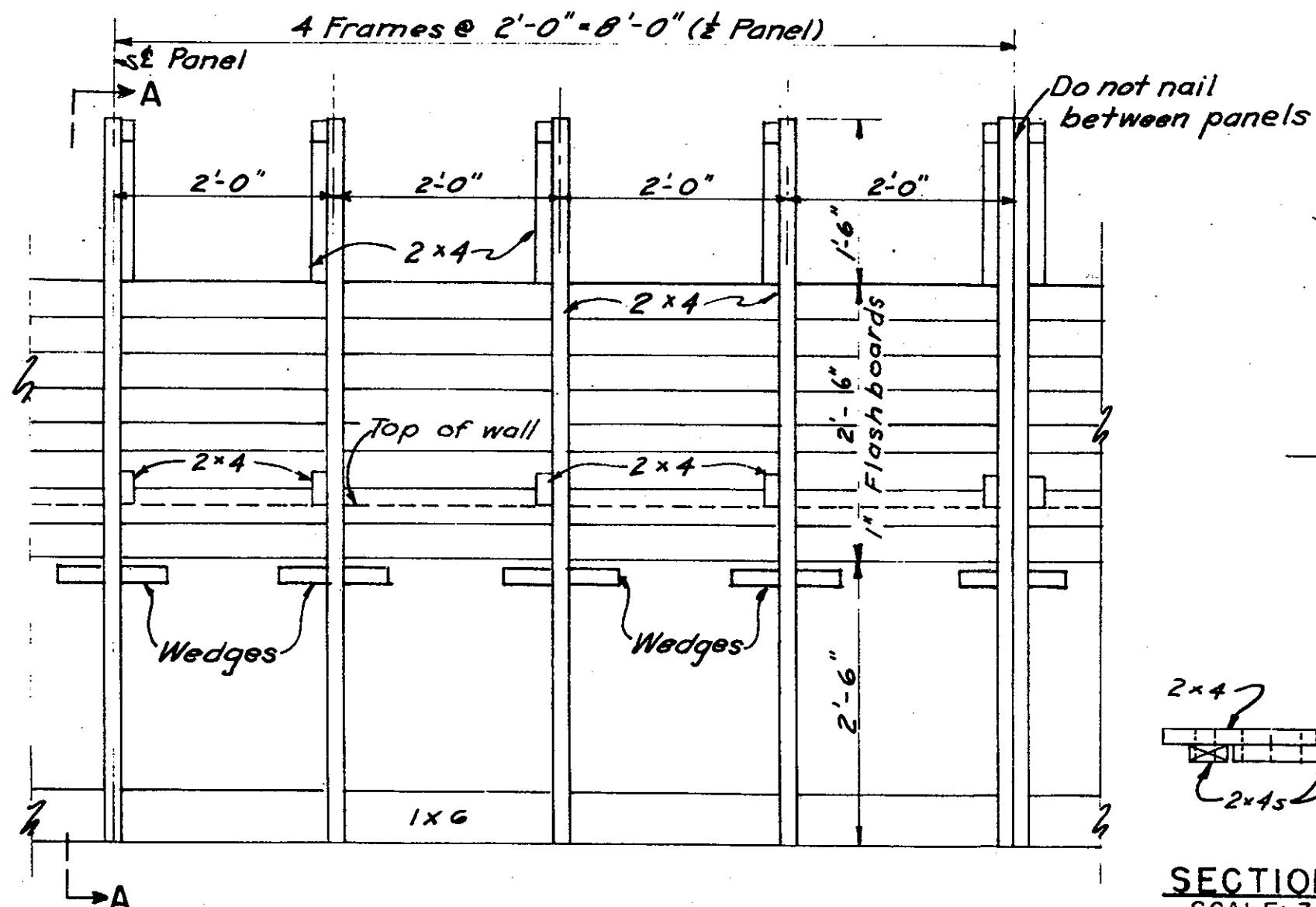
AS-BUILT DRAWINGS

<u>Title</u>	<u>Plate No.</u>
Project Plan and Index	1
General Plan and Profile No. 1	2
General Plan and Profile No. 2	3
Sections and Details No. 1	4
Sections and Details No. 2	5
Sections and Details No. 3	6
Drainage Plan	7
Drainage Profile and Details	8
T-wall - Reinforcing Details	9
Utility Structures - Reinforcing Details	10
North and South Vehicular Gates - Plans and Sections	11
Vehicular Gates - Reinforcing Details	12
Vehicular Gates - Structural Details No. 1	13
Vehicular Gates - Structural Details No. 2	14
Pumping Station - Architectural Plans, Elevations and Sections	15
Pumping Station - Architectural Elevations, Sections and Details	16
Pumping Station - Structural Reinforcing Details No. 1	17
Pumping Station - Structural Reinforcing Details No. 2	18
Pumping Station - Structural Reinforcing Details No. 3	19
Pumping Station - Structural Steel and Miscellaneous Metal Details	20
Pumping Station - Mechanical Plans, Sections and Details No. 1	21
Pumping Station - Mechanical Plans, Sections and Details No. 2	22
Pumping Station - Electrical Plans and Details	23
Plan of Foundation Explorations and Geologic Section	24
Record of Foundation Explorations	25



ELEVATION OF FLASHBOARDS

SCALE: 1/16" = 1'-0"

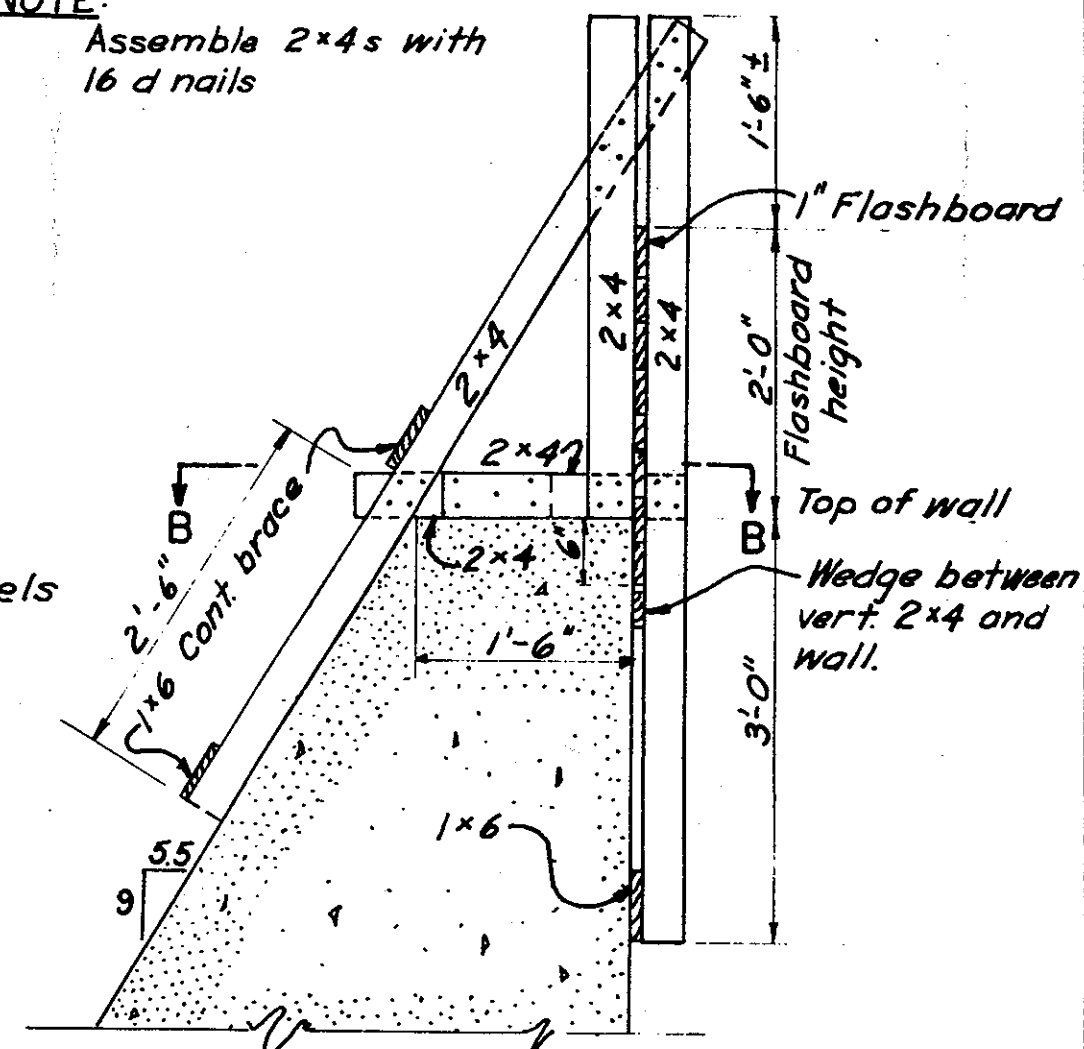


DETAIL ELEVATION OF FLASHBOARD FRAMES

SCALE: 3/4" = 1'-0"

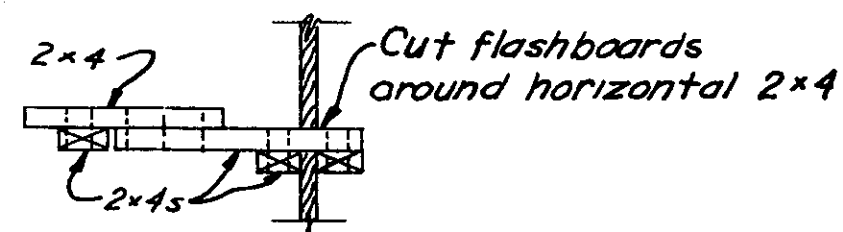
NOTE:

Assemble 2x4s with 16 d nails



SECTION A-A

SCALE: 3/4" = 1'-0"

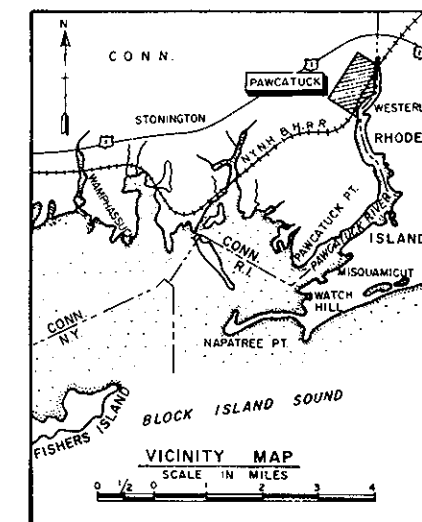
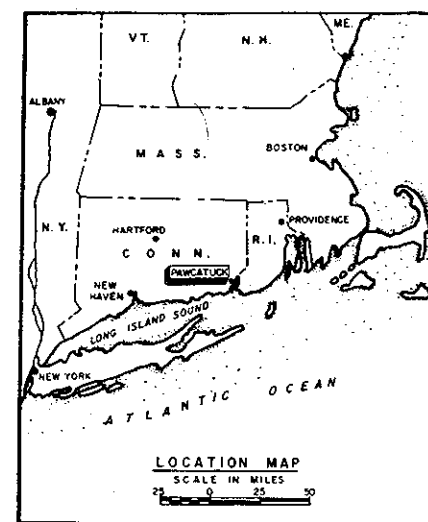


SECTION B-B

SCALE: 3/4" = 1'-0"

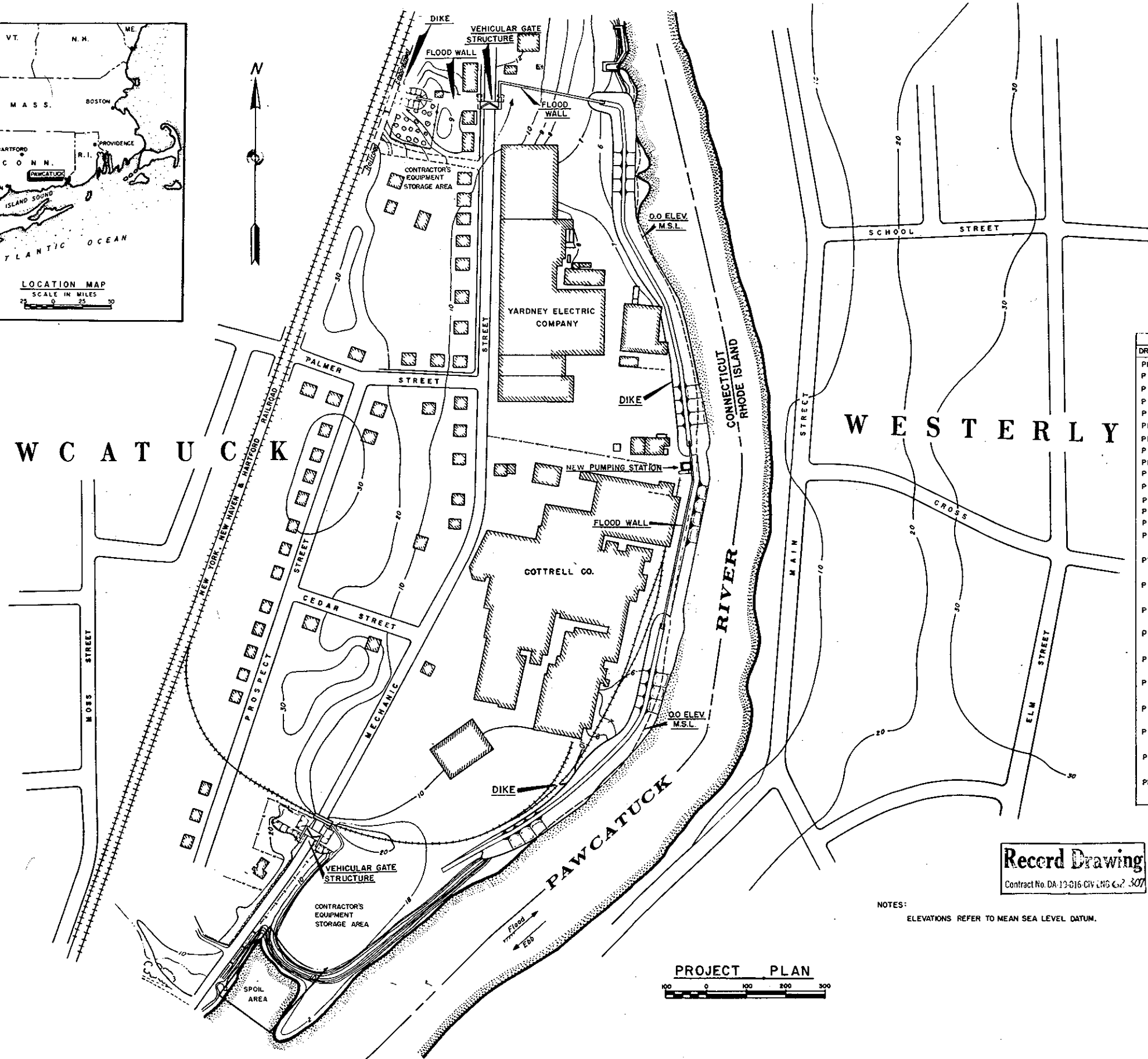
FLOOD EMERGENCY
MEASURES

FLASHBOARDS



PAWCATUCK

WESTERLY



INDEX TO DRAWINGS	
DRAWING NO. (SHEET NO.)	TITLE
PHB-1-1015	1 PROJECT PLAN AND INDEX
PHB-1-1016	2 GENERAL PLAN AND PROFILE NO.1
PHB-1-1017	3 GENERAL PLAN AND PROFILE NO.2
PHB-1-1018	4 SECTIONS AND DETAILS NO.1
PHB-1-1019	5 SECTIONS AND DETAILS NO.2
PHB-1-1020	6 SECTIONS AND DETAILS NO.3
PHB-1-1021	7 DRAINAGE PLAN
PHB-1-1022	8 DRAINAGE PROFILE AND DETAILS
PHB-1-1023	9 TEE WALL - REINFORCING DETAILS
PHB-1-1024	10 UTILITY STRUCTURES - REINFORCING DETAILS
PHB-1-1025	11 NORTH AND SOUTH VEHICULAR GATES - PLANS & SECTIONS
PHB-1-1026	12 VEHICULAR GATES - REINFORCING DETAILS
PHB-1-1027	13 VEHICULAR GATES - STRUCTURAL DETAILS NO.1
PHB-1-1028	14 VEHICULAR GATES - STRUCTURAL DETAILS NO.2
PHB-1-1029	15 PUMPING STATION - ARCHITECTURAL - PLANS, ELEVATION AND SECTIONS
PHB-1-1030	16 PUMPING STATION - ARCHITECTURAL - ELEVATIONS, SECTIONS AND DETAILS
PHB-1-1031	17 PUMPING STATION - STRUCTURAL - REINFORCING DETAILS NO.1
PHB-1-1032	18 PUMPING STATION - STRUCTURAL - REINFORCING DETAILS NO.2
PHB-1-1033	19 PUMPING STATION - STRUCTURAL - REINFORCING DETAILS NO.3
PHB-1-1034	20 PUMPING STATION - STRUCTURAL - STEEL AND MISCELLANEOUS METAL DETAILS
PHB-1-1035	21 PUMPING STATION - MECHANICAL - PLANS, SECTIONS AND DETAILS NO.1
PHB-1-1036	22 PUMPING STATION - MECHANICAL - PLANS, SECTIONS AND DETAILS NO.2
PHB-1-1037	23 PUMPING STATION - ELECTRICAL - PLANS AND DETAILS
PHB-1-1038	24 PLAN OF FOUNDATION EXPLORATIONS AND GEOLOGIC SECTION
PHB-1-1039	25 RECORD OF FOUNDATION EXPLORATIONS

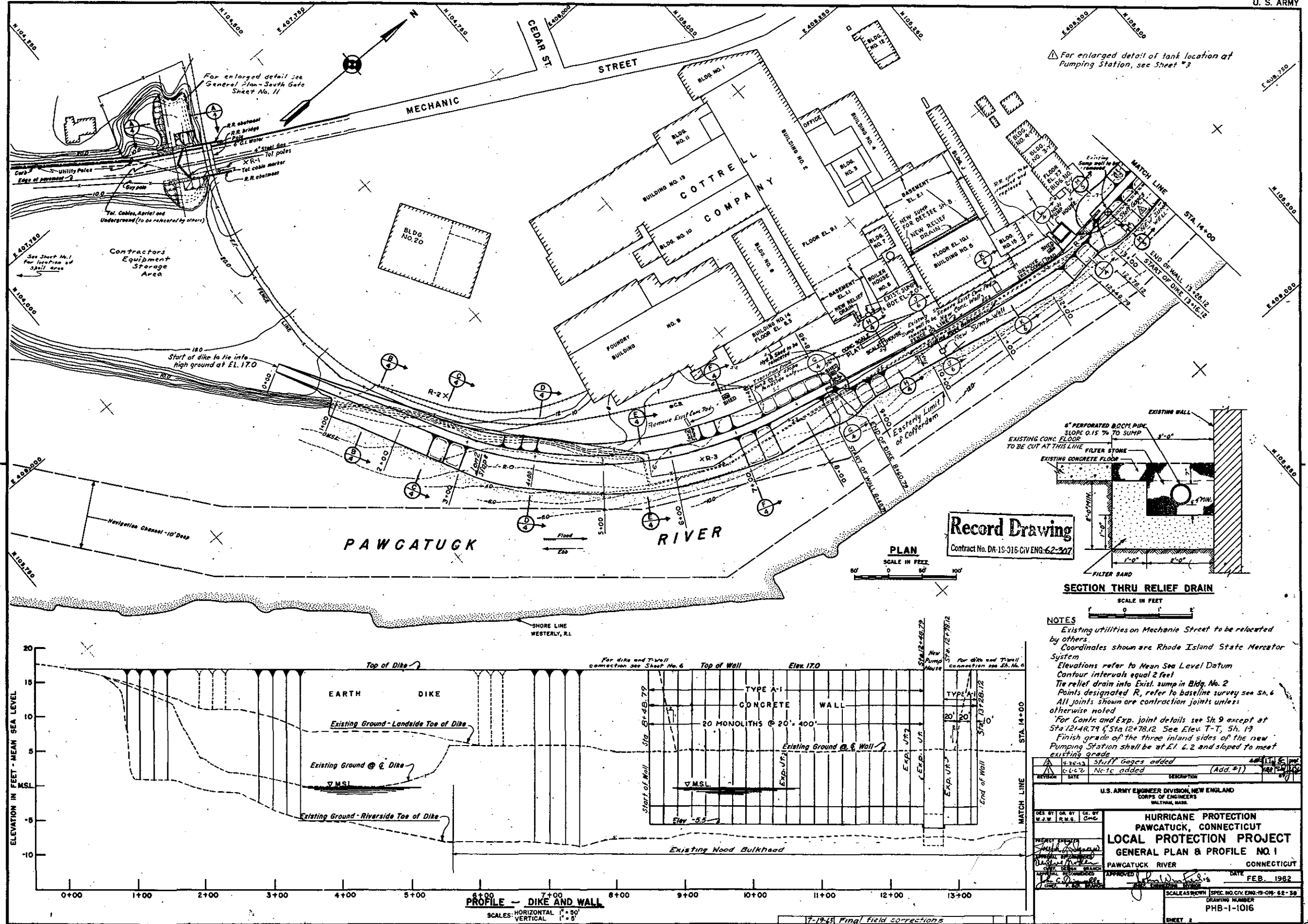
Record Drawing
Contract No. DA-13-016 CIV ENG C-2-307

NOTES:
ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

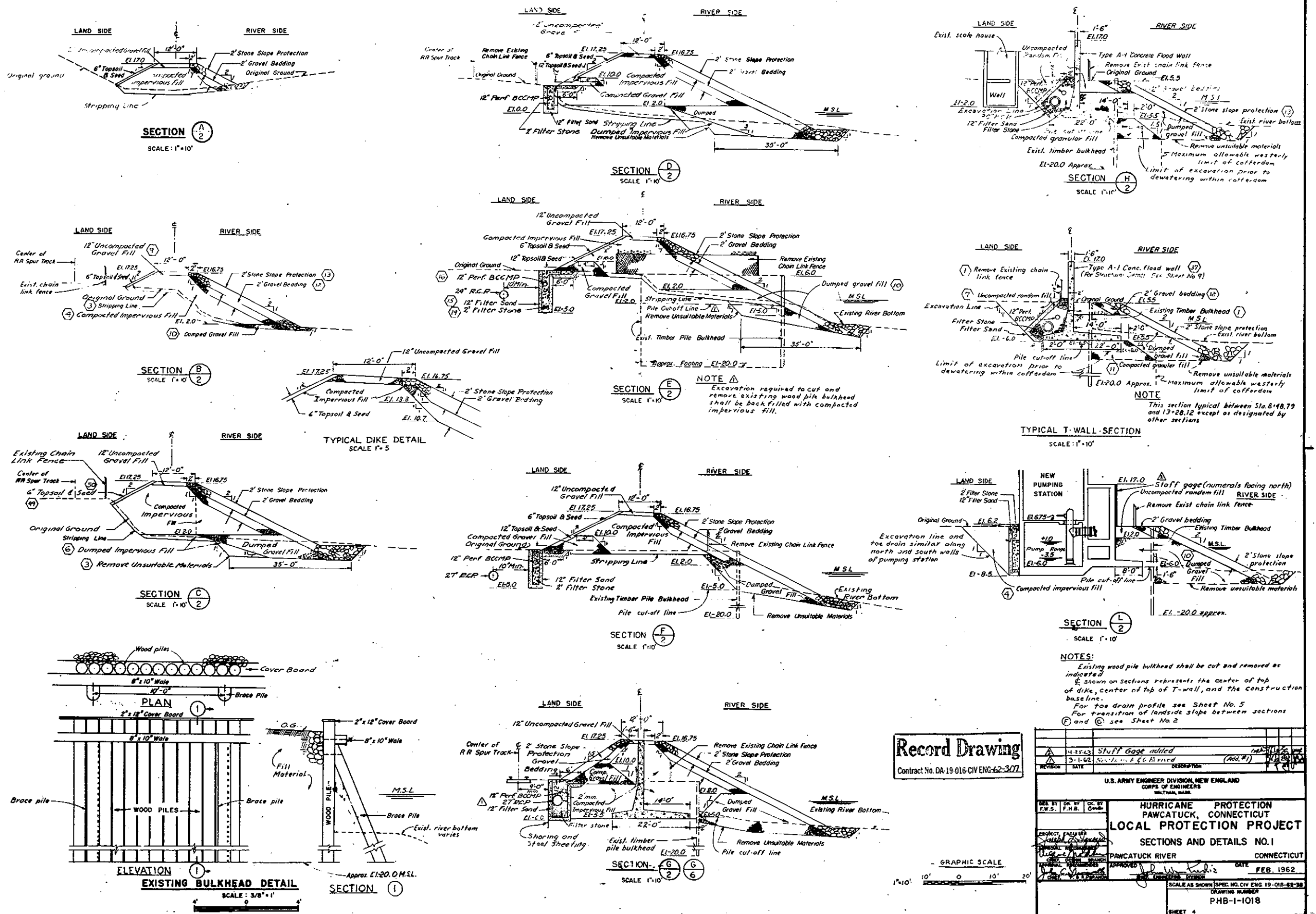
PROJECT PLAN

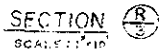
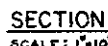
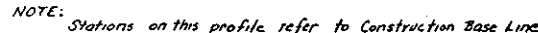


U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
HURRICANE PROTECTION PAWCATUCK, CONNECTICUT LOCAL PROTECTION PROJECT PROJECT PLAN AND INDEX	
DES. BY D.H.H.	DR. BY P.H.B.
CHECKED J. H. H.	APPROVED J. H. H.
PAWCATUCK RIVER CONNECTICUT	
DATE FEB. 1982	
SCALE 1"=100' SPEC. NO. CIV ENG. 7-04-82-138	
DRAWING NUMBER PHB-1-1015	
SHEET 1	









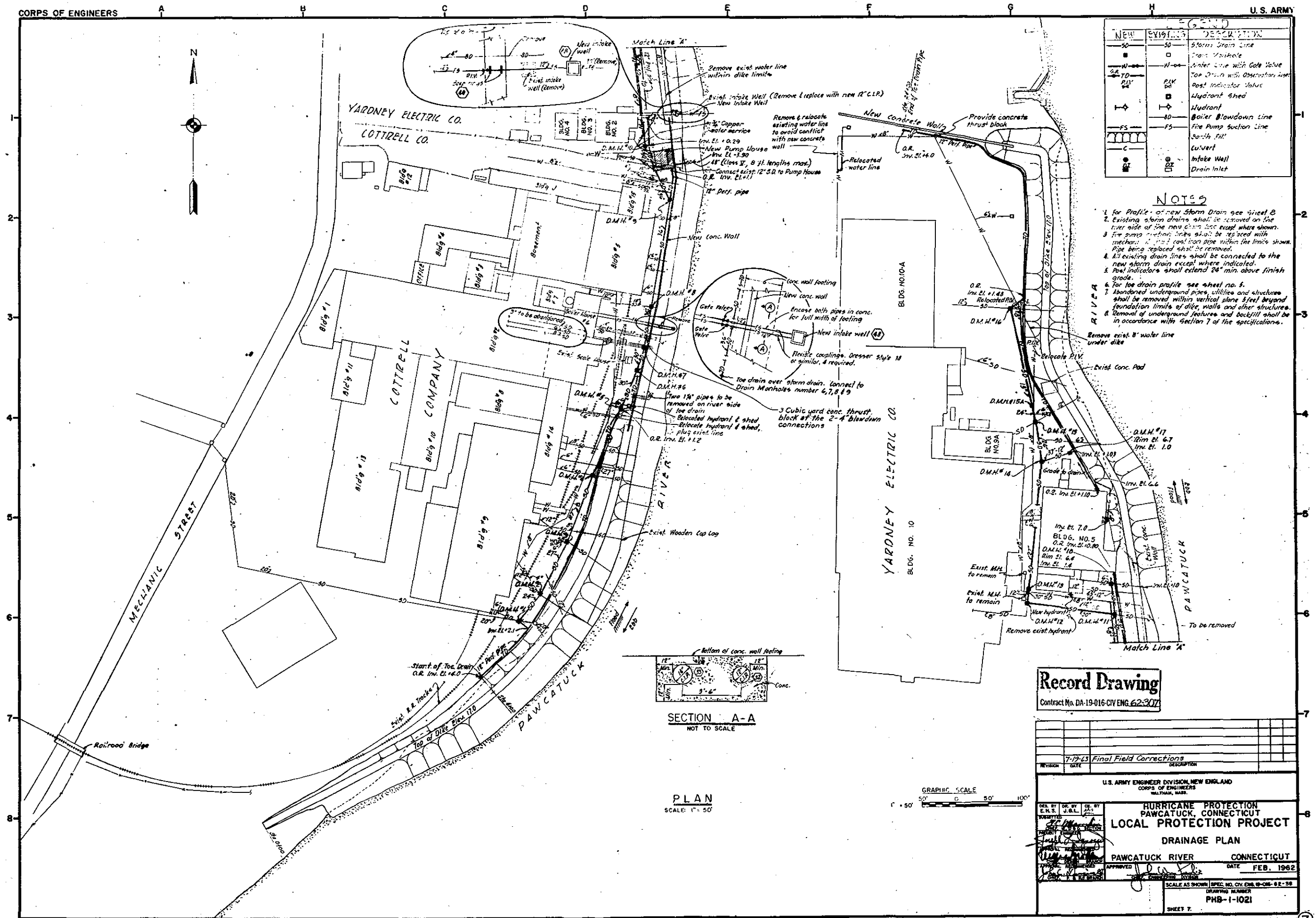
Contract No. DA-19-016-CIV ENG-62-307

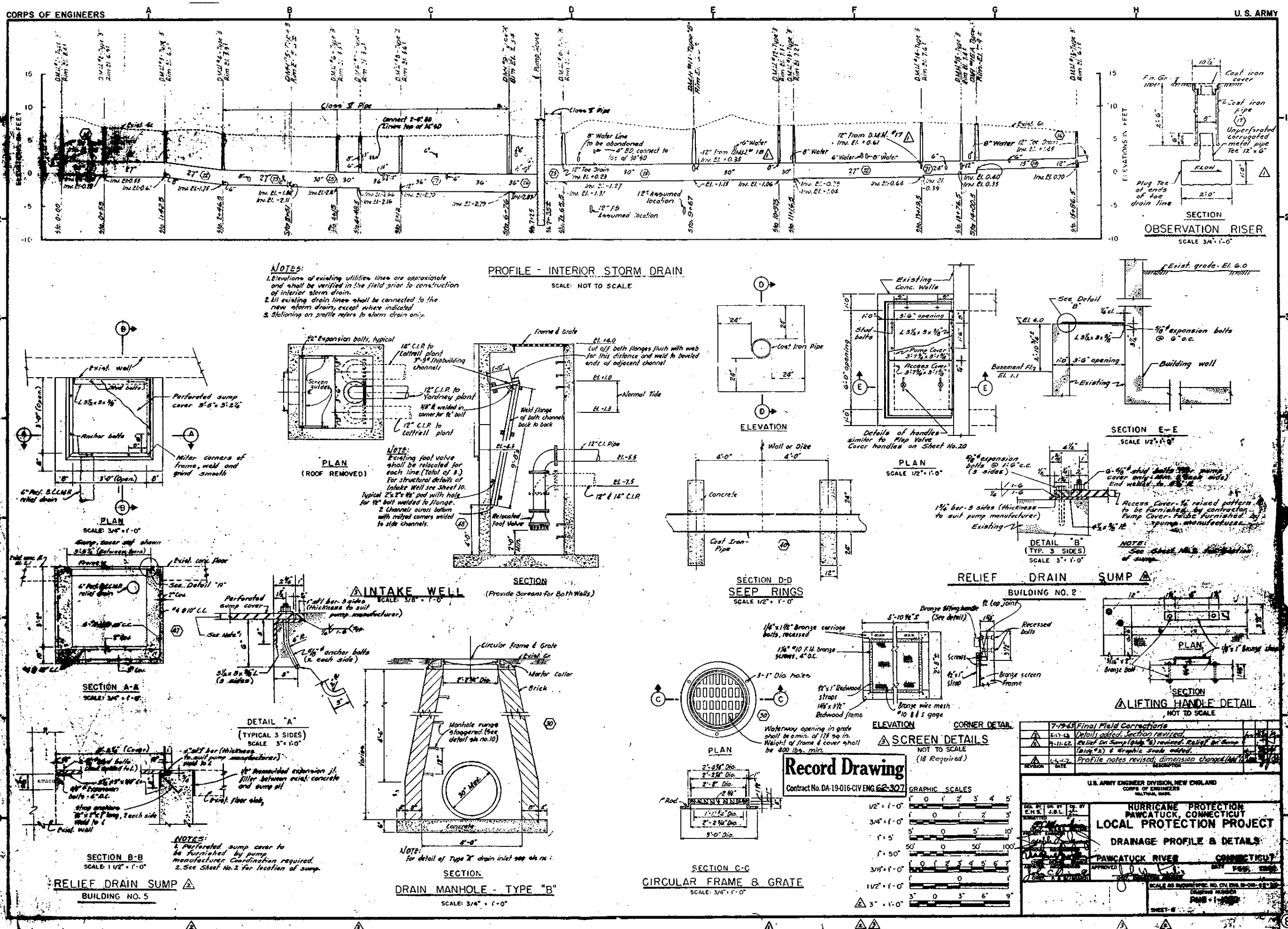
	7-19-63	Final field corrections			
	4-25-63	Staff Gage added			
	6-6-62	Dimensions added (Add. #1)			
REVISION	DATE	DESCRIPTION			

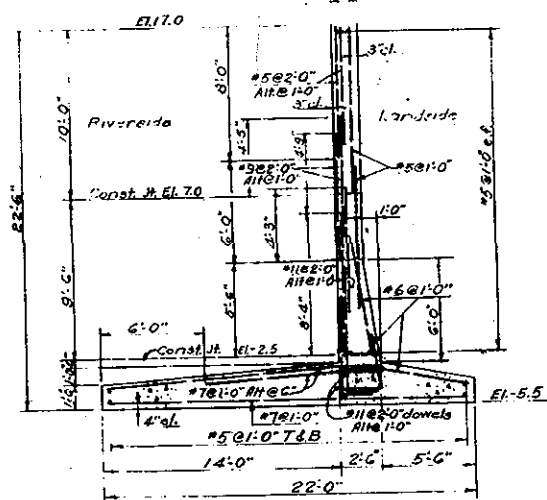
**HURRICANE PROTECTION
PAWCATUCK, CONNECTICUT
LOCAL PROTECTION PROJECT
SECTIONS AND DETAILS NO.2**

SCALE 1"=60' SPEC. NO. CIV. ENGR. 18-08-82-38
DRAWING NUMBER
P&S-1-1019
SHEET 3

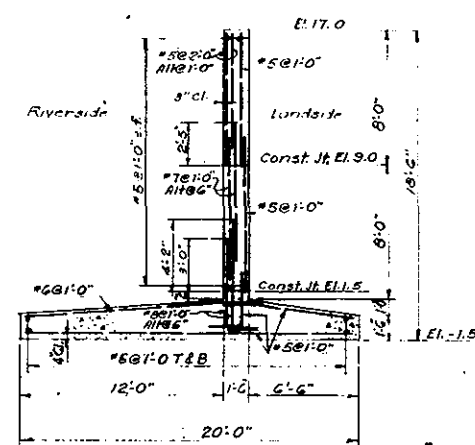




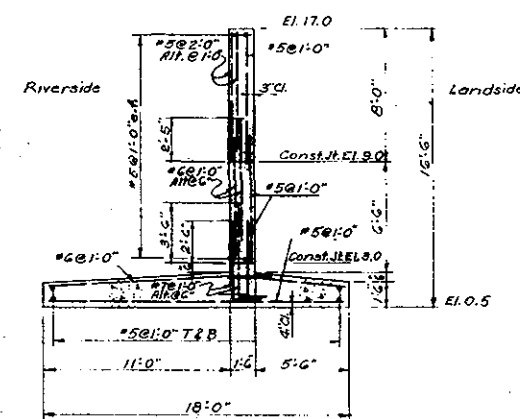




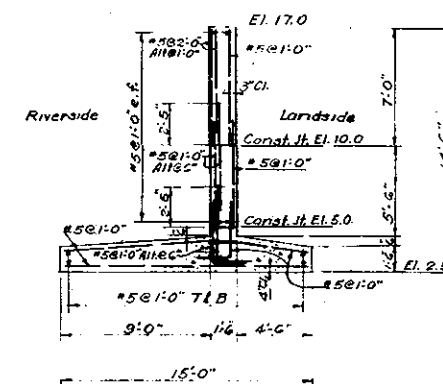
TYPE A-1 FLOOD WALL
SCALE $\frac{1}{2}" = 1'-0"$



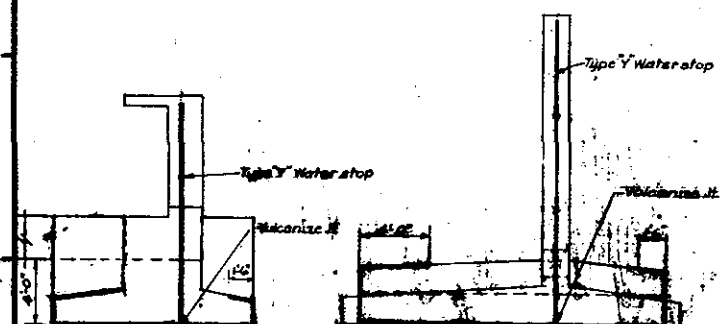
TYPE A-2 FLOOD WALL
SCALE: $\frac{1}{2}$ " = 1'-0"



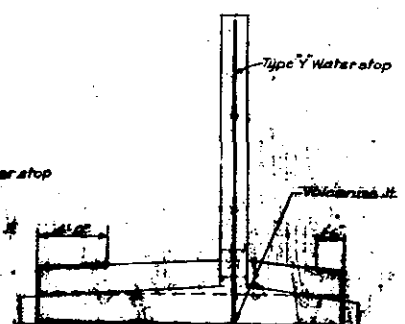
TYPE A-3 FLOOD WALL
SCALE: $\frac{1}{2}'' = 1'-0''$



TYPE A-4 FLOOD WALL
SCALE: $\frac{1}{4}"=1'-0"$

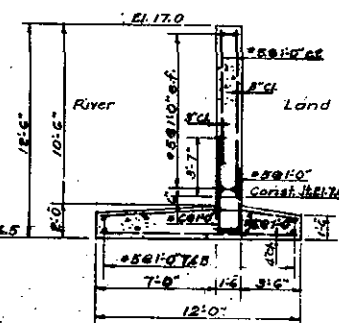


SECTION 11

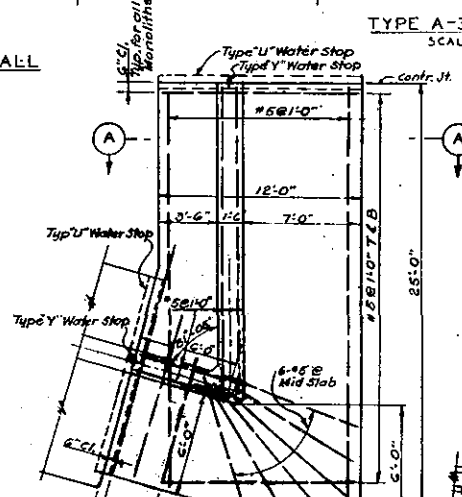


SECTION B-B 74

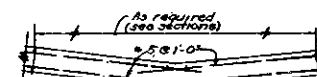
WATER STOP DETAIL AT STOP FOOTING



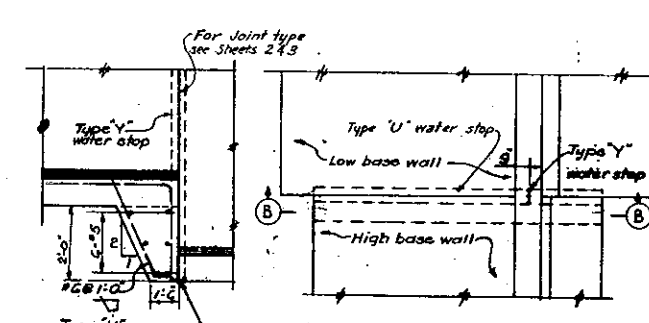
SECTION A-A
AND
TYPE A-5 FLOOD WALL
SCALE 1" = 1'-0"



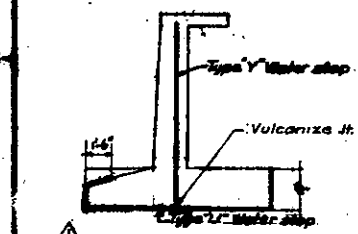
TYPICAL DETAIL AT CORNER
SCALE: 1" = 1'-0"



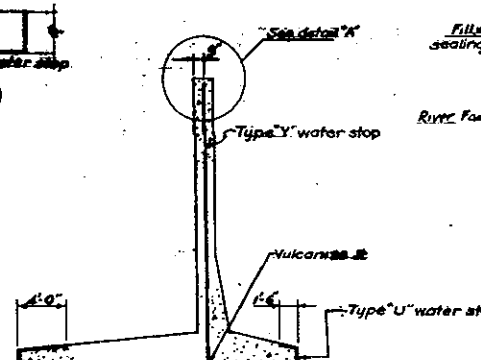
TYPICAL REINFORCING
AT WALL ANGLE BEND
SCALE 1/2"=1'-0"



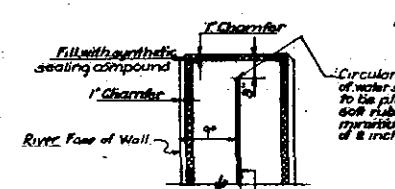
**TYPICAL STEP FOOTING
AT MONOLITH JOINTS**



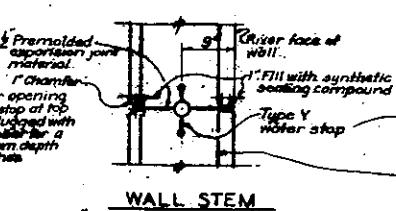
SECTION 
SCALE: 1" = 1'-0"



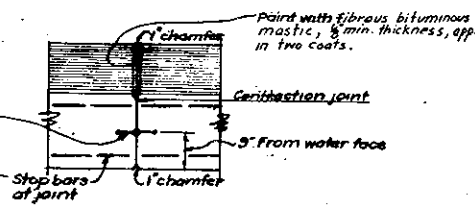
TYPE "A" FLOOD WALL



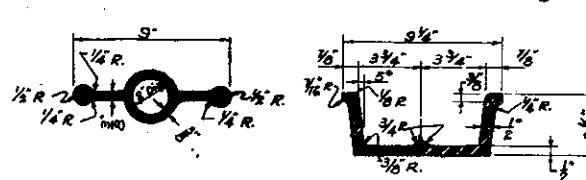
DETAIL "A"
SCALE 1" = 1'-0"



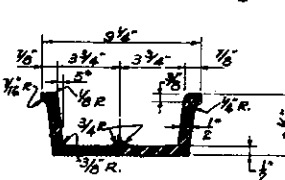
WALL STEM
EXPANSION JOINT



WALL STEM
CONTRACTION JOINT



TYPE "Y"




TYPE _____

Record Drawing

Contract No. D3-19-016-CIV-ENG-230

GRAPHIC: RCA ES



Size	Measurements
3/16" x 1" - 0"	8, 4, 0
1/4" x 1" - 0"	4, 0, 4
3/4" x 1" - 0"	1, 0, 1, 2
1" x 1" - 0"	0, 1
3" x 1" - 0"	3, 0, 3, 6

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS

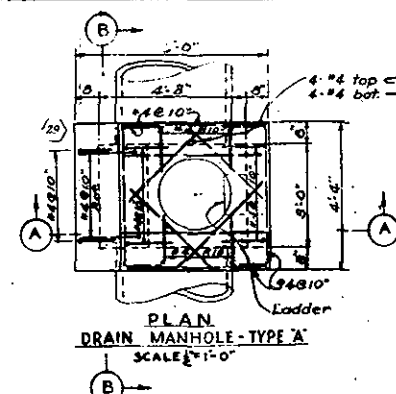
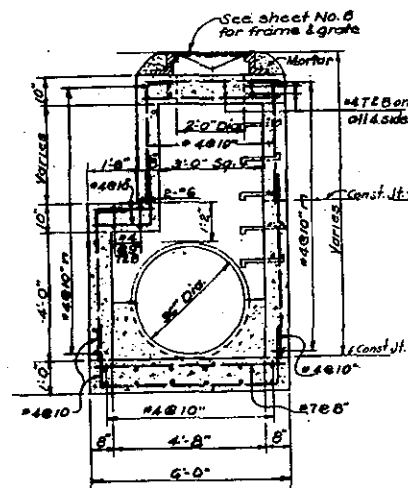
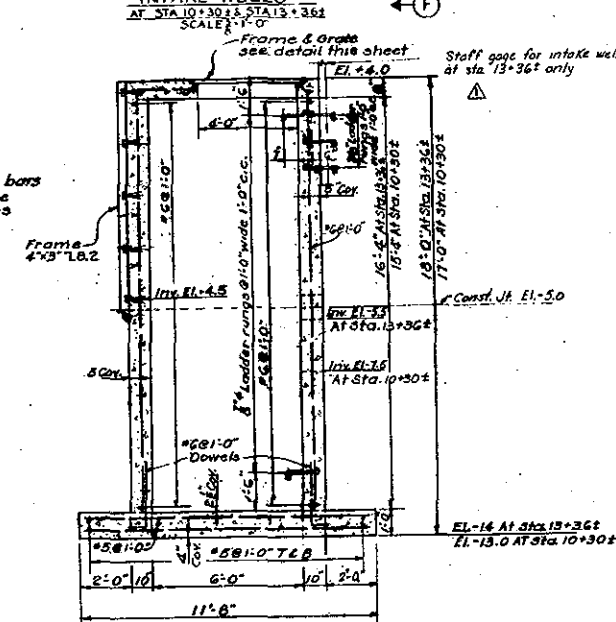
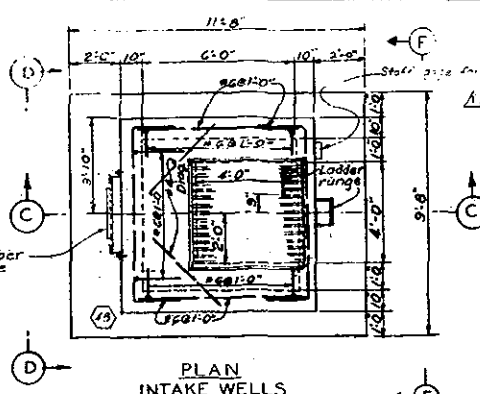
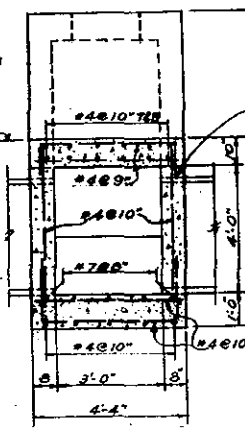
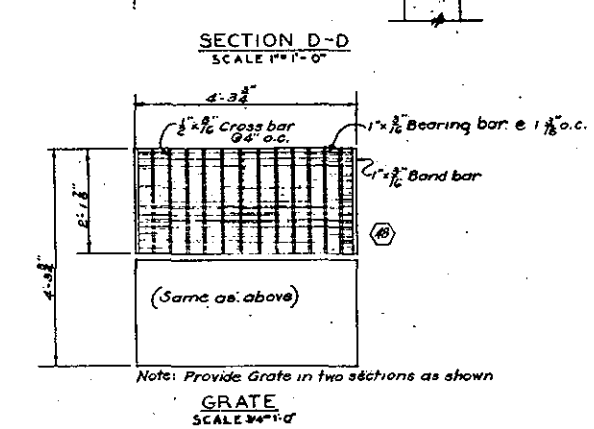
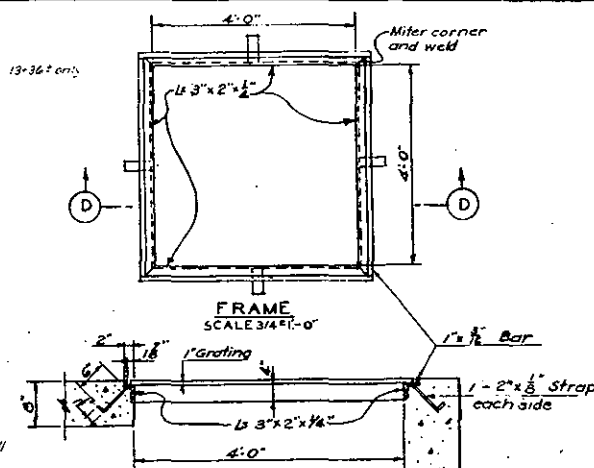
HURRICANE PROTECTION
PAWCATUCK, CONNECTICUT
LOCAL PROTECTION PROJECT
TEE WALL - REINFORCING DETAILS

PAWCATUCK RIVER CONNECT

SCALE AS SHOWN SPEC. NO. CIV. ENG. 18-016

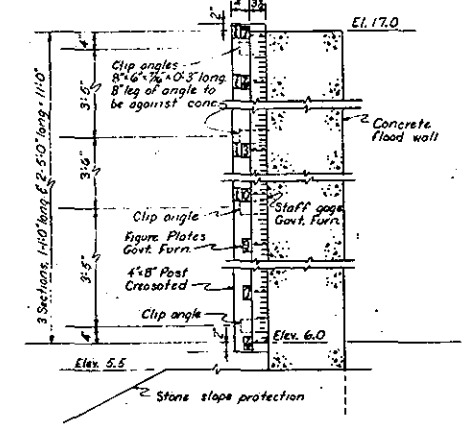
DRAWING NUMBER
PHB-1-1023

SHEET 9

LADDER RUNG DETAIL
SCALE 1/2"=1'-0"SECTION B-B
SCALE 1/2"=1'-0"SECTION C-C
SCALE 1/2"=1'-0"SECTION D-D
SCALE 1/2"=1'-0"

Note: Provide Grate in two sections as shown

GRATE
SCALE 3/4"=1'-0"

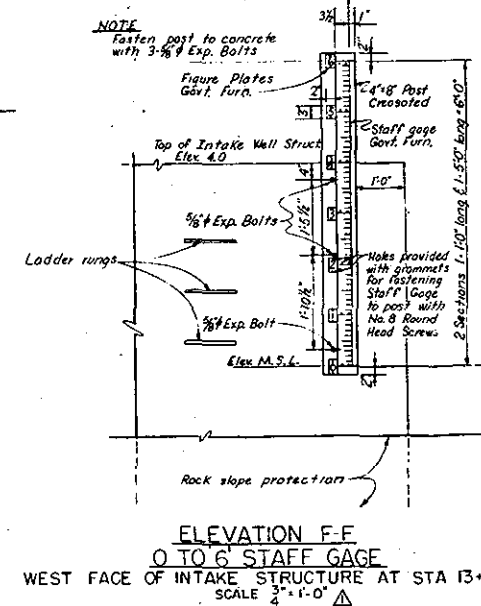
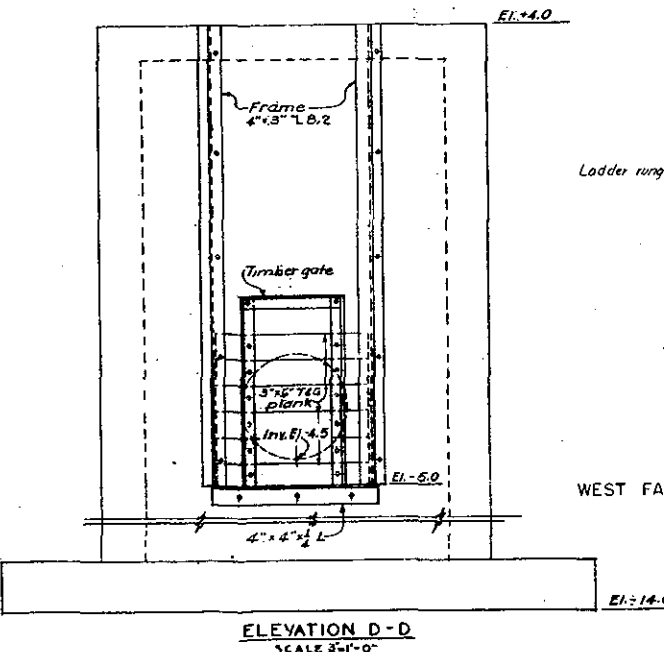
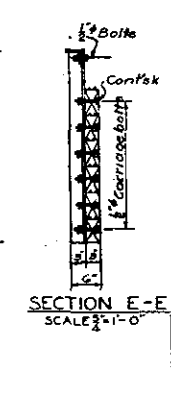
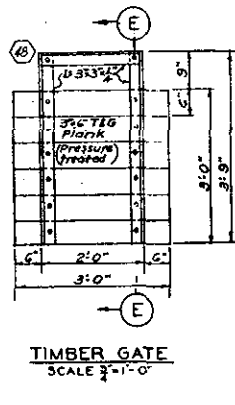
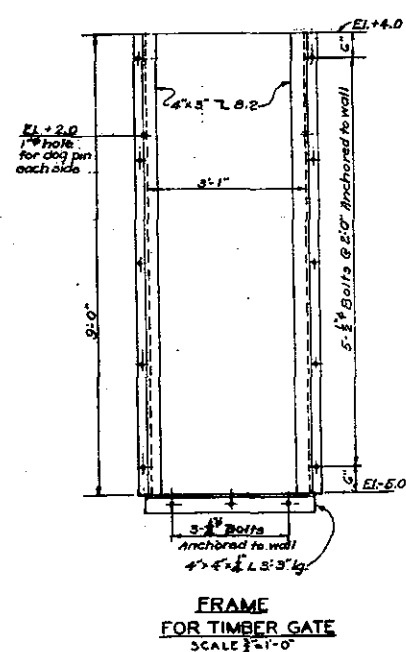


NOTES:

1. Fasten post to concrete flood wall with 4 clip angles.
Use two 1/4" exp. bolts in concrete and two 1/4" leg bolts 3' long
in wood of each clip angle.

2. Holes are provided with grannets for fastening staff
gage and figure plates to post with No. 8 round head screws

6' TO 17' STAFF GAGE
EAST FACE OF FLOOD WALL AT STA. 12+80
SCALE 1/2"=1'-0"



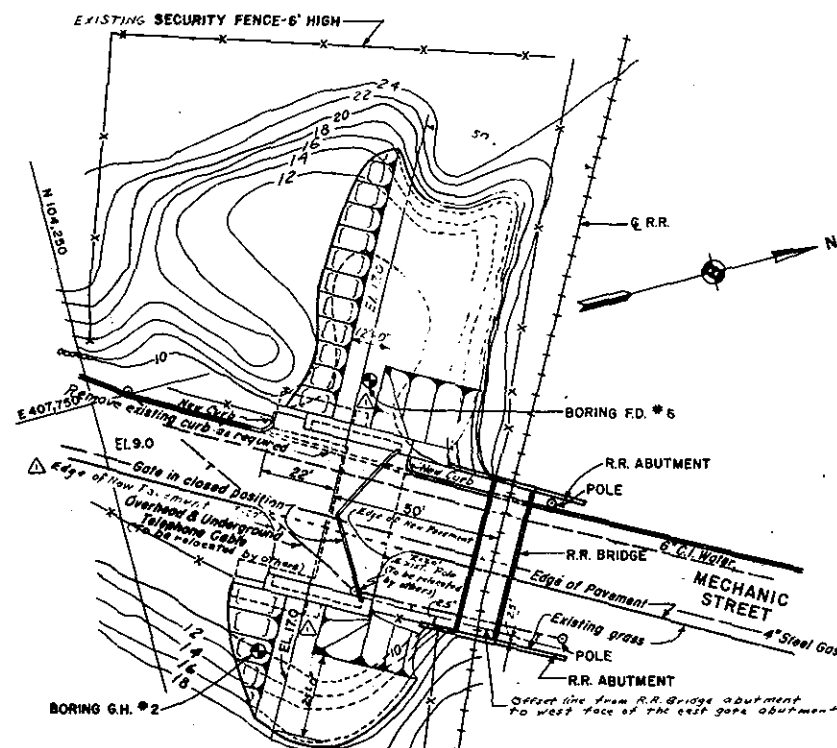
NOTES:

For general notes see Sheet No. 17

Record Drawing

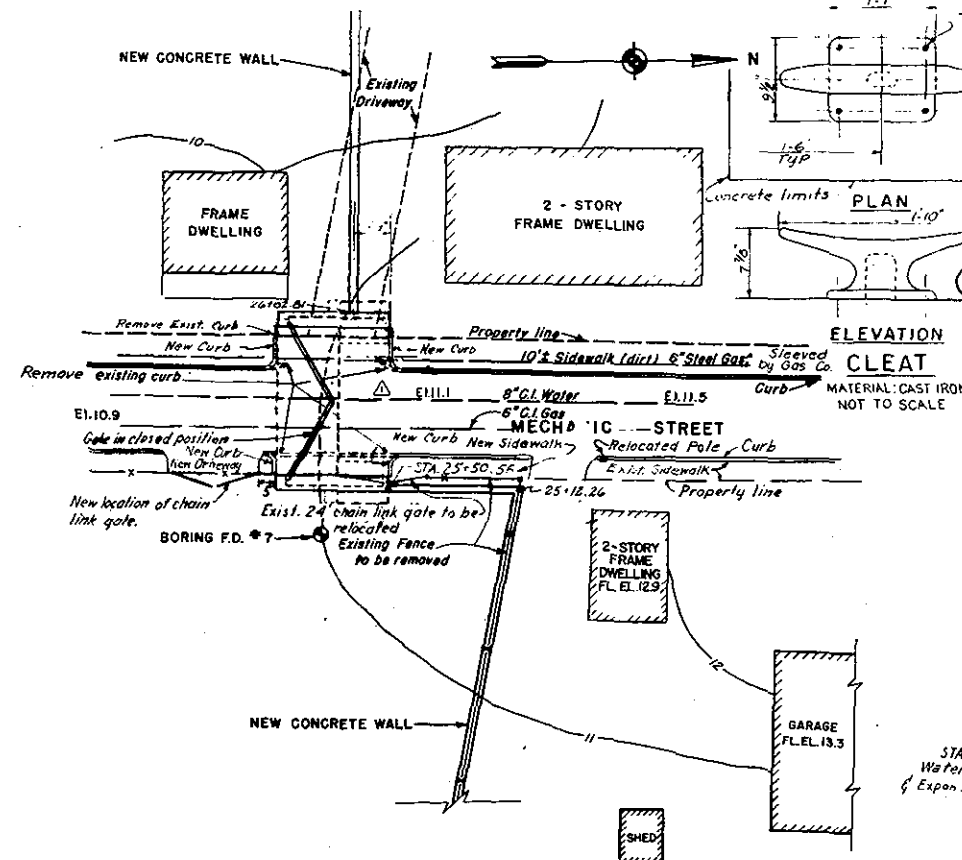
Contract No. DA-19-016-CIV ENG-62-307

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
DESIGNED BY H. J. B. B.	CHECKED BY A. J. B.
HURRICANE PROTECTION PAWCATUCK, CONNECTICUT LOCAL PROTECTION PROJECT UTILITY STRUCTURES-REINFORCING DETAILS	
PAWCATUCK RIVER	CONNECTICUT
DATE FEB. 1962	SCALE AS SHOWN SHEET NO. CIV. ENG. 18-06-62-307
DRAWING NUMBER PHB-1-1024	SHEET 10



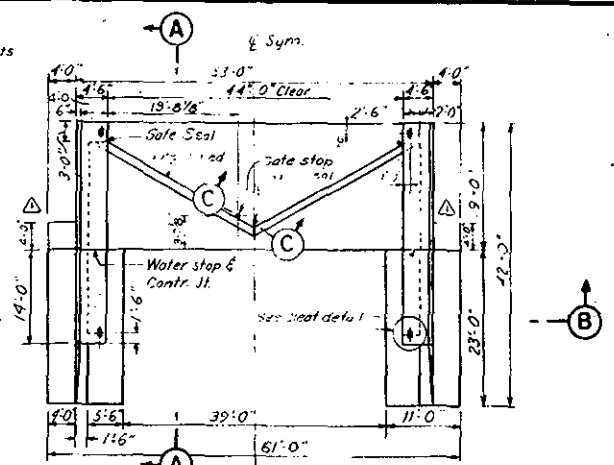
GENERAL PLAN - SOUTH GATE

SCALE 1"=20'



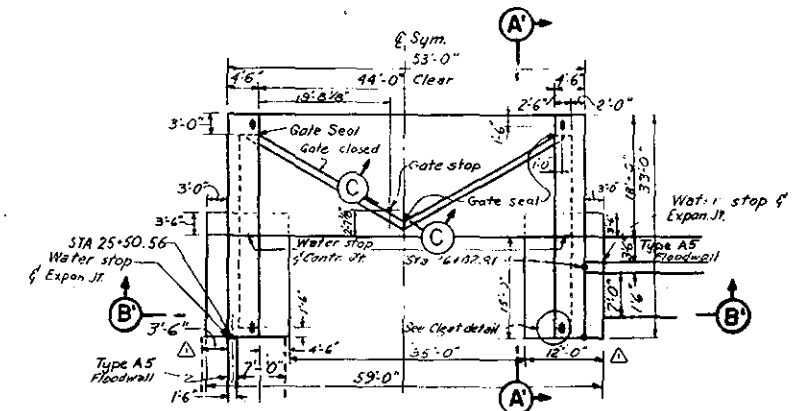
GENERAL PLAN - NORTH GATE

SCALE 1"=20'



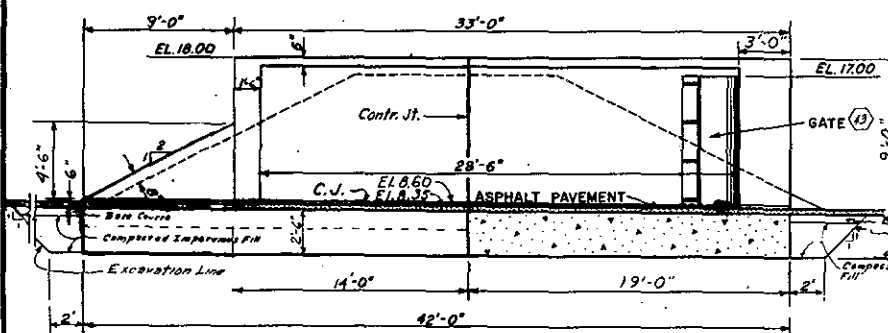
PLAN - SOUTH VEHICULAR GATE

SCALE 1"=10'



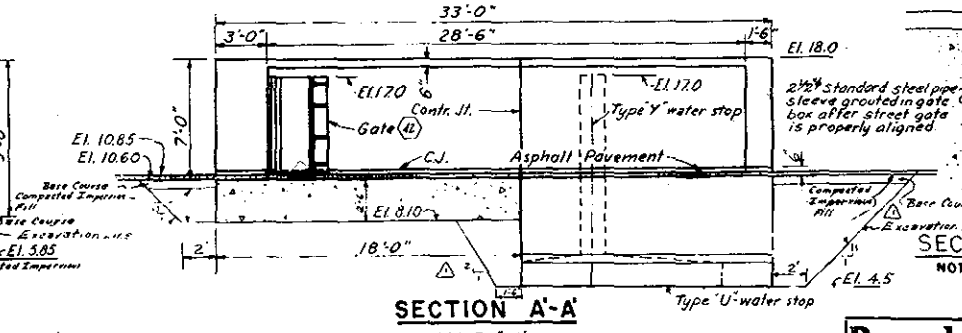
PLAN - NORTH VEHICULAR GATE

SCALE 1"=10'



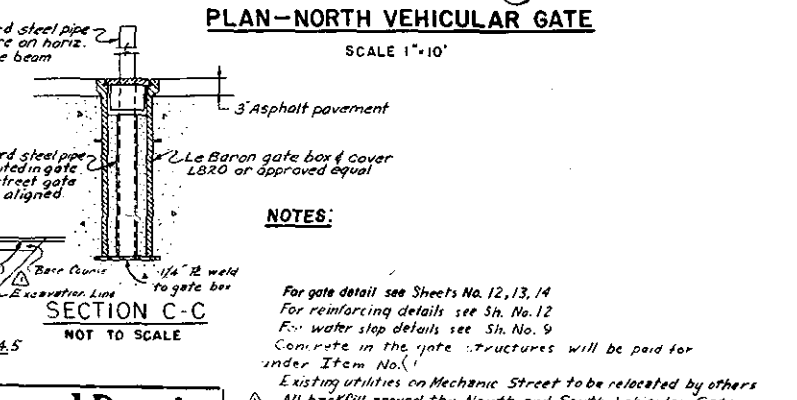
SECTION A-A

SCALE 1"=4'



SECTION A-A

SCALE 1"=4'



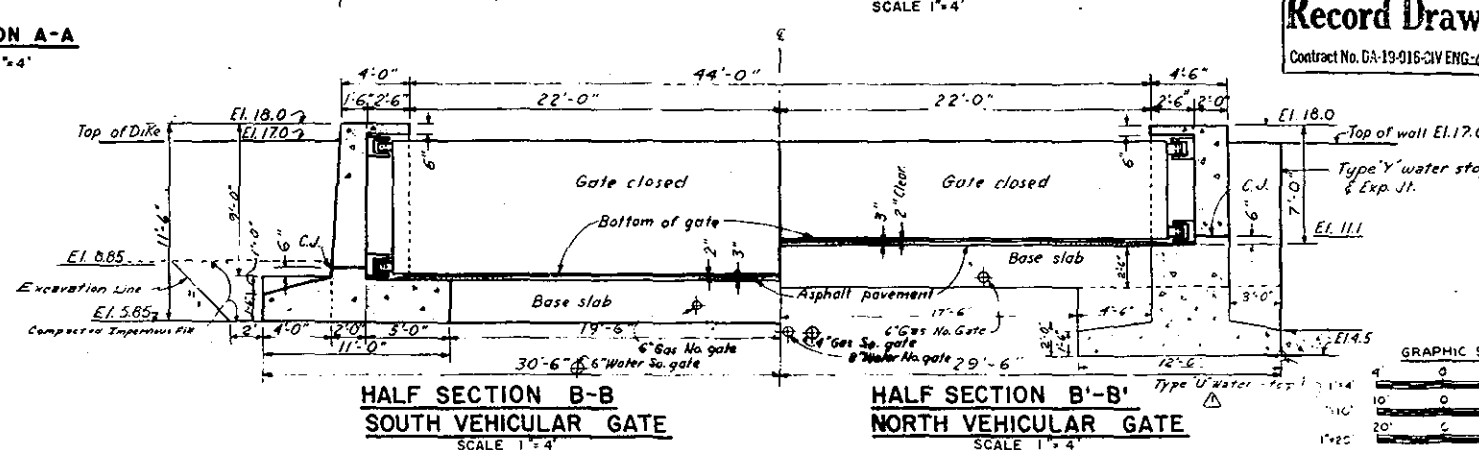
SECTION C-C

NOT TO SCALE

Record Drawing
Contract No. DA-19-016-CIV-ENG-62-307

NOTES:

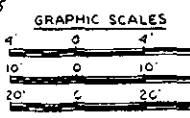
- For gate detail see Sheets No. 12, 13, 14
- For reinforcing details see Sh. No. 12
- For water stop details see Sh. No. 9
- Concrete in the gate structures will be paid for under Item No. 1
- Existing utilities on Mechanic Street to be relocated by others
- All backfill around the North and South vehicular Gates shall be compacted imper. sus fill

HALF SECTION B-B
SOUTH VEHICULAR GATE

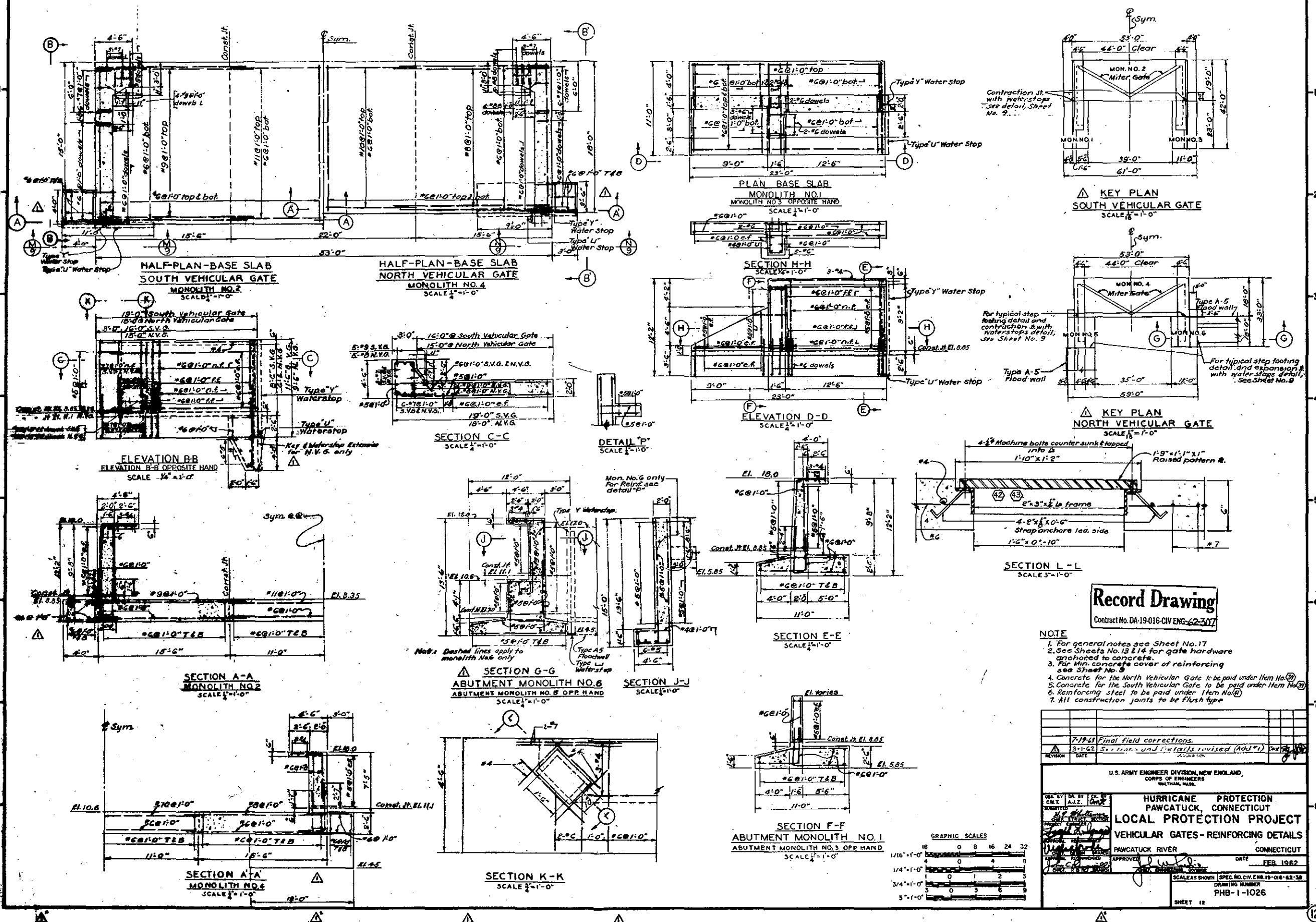
SCALE 1"=4'

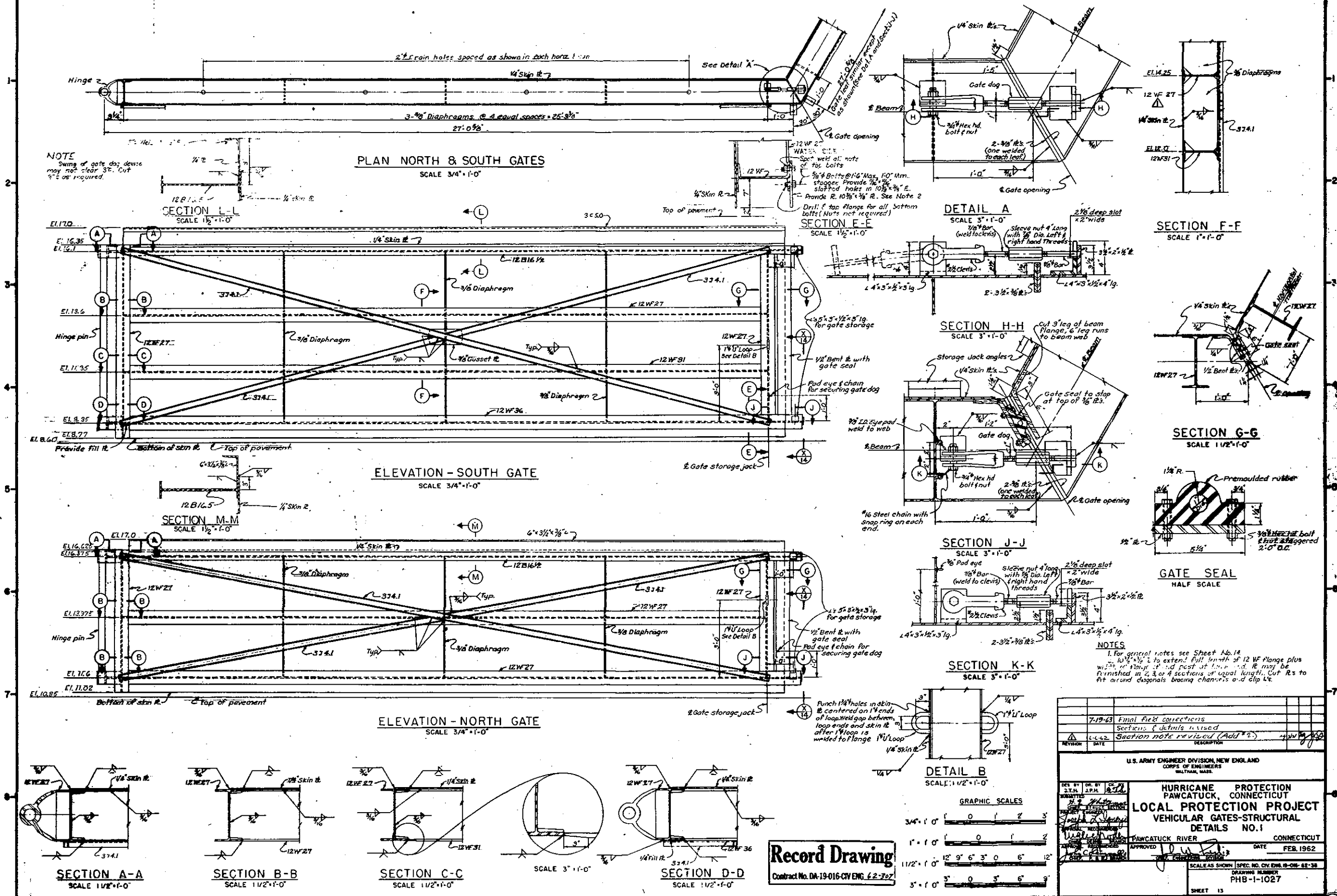
HALF SECTION B-B
NORTH VEHICULAR GATE

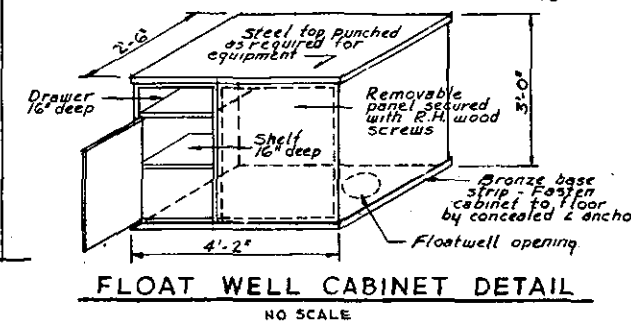
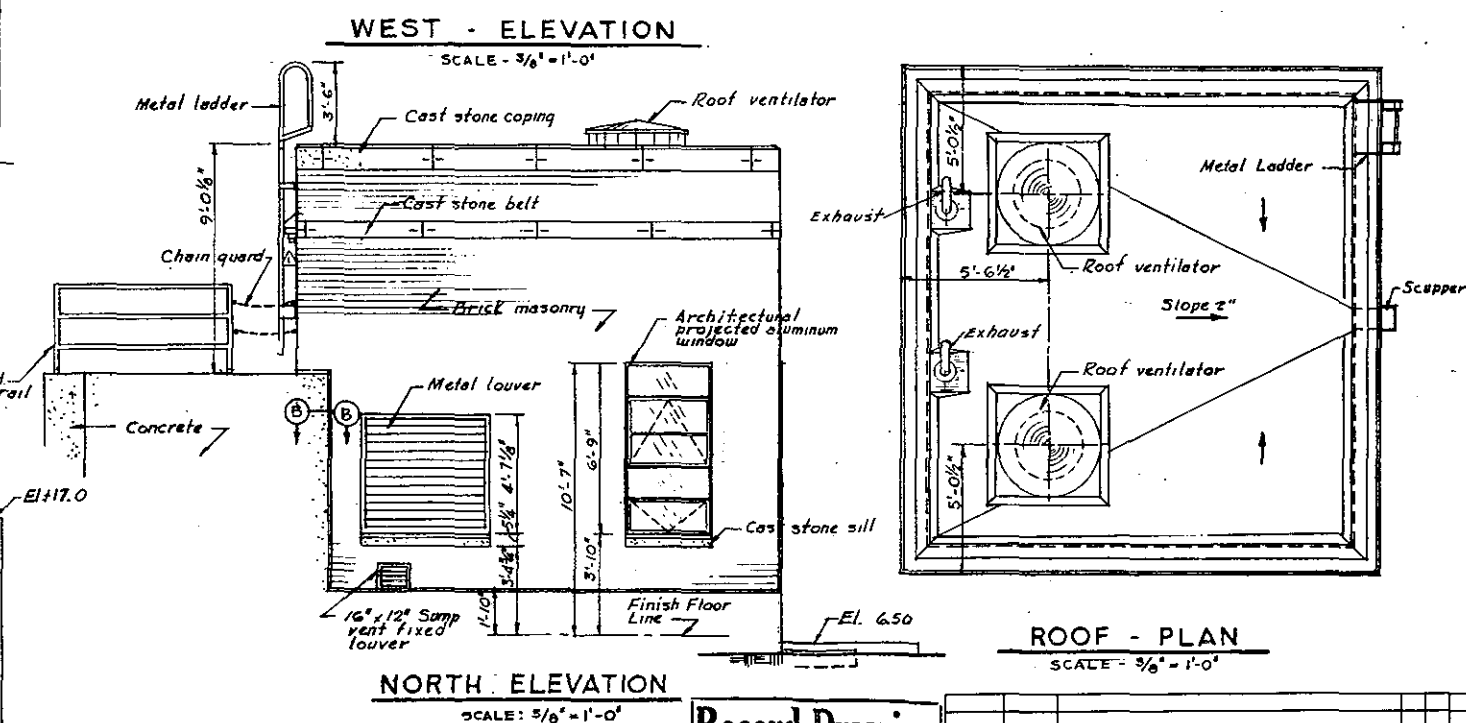
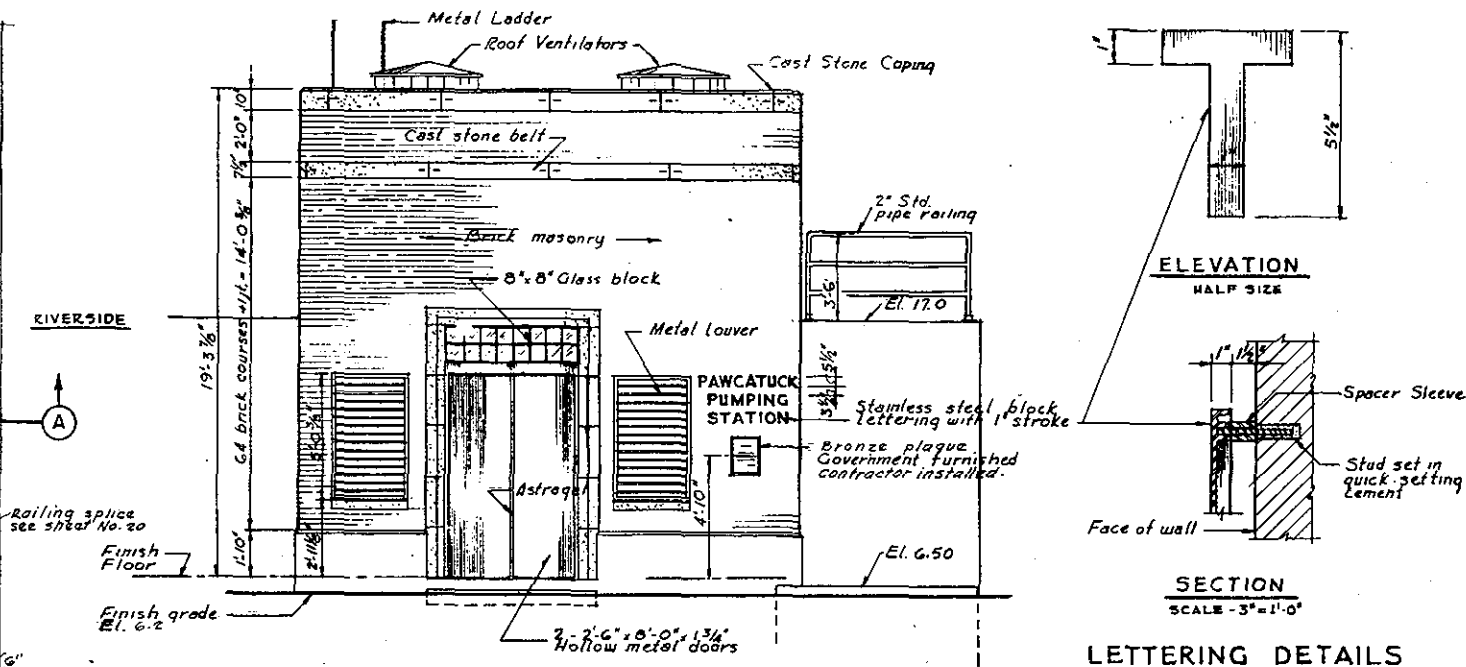
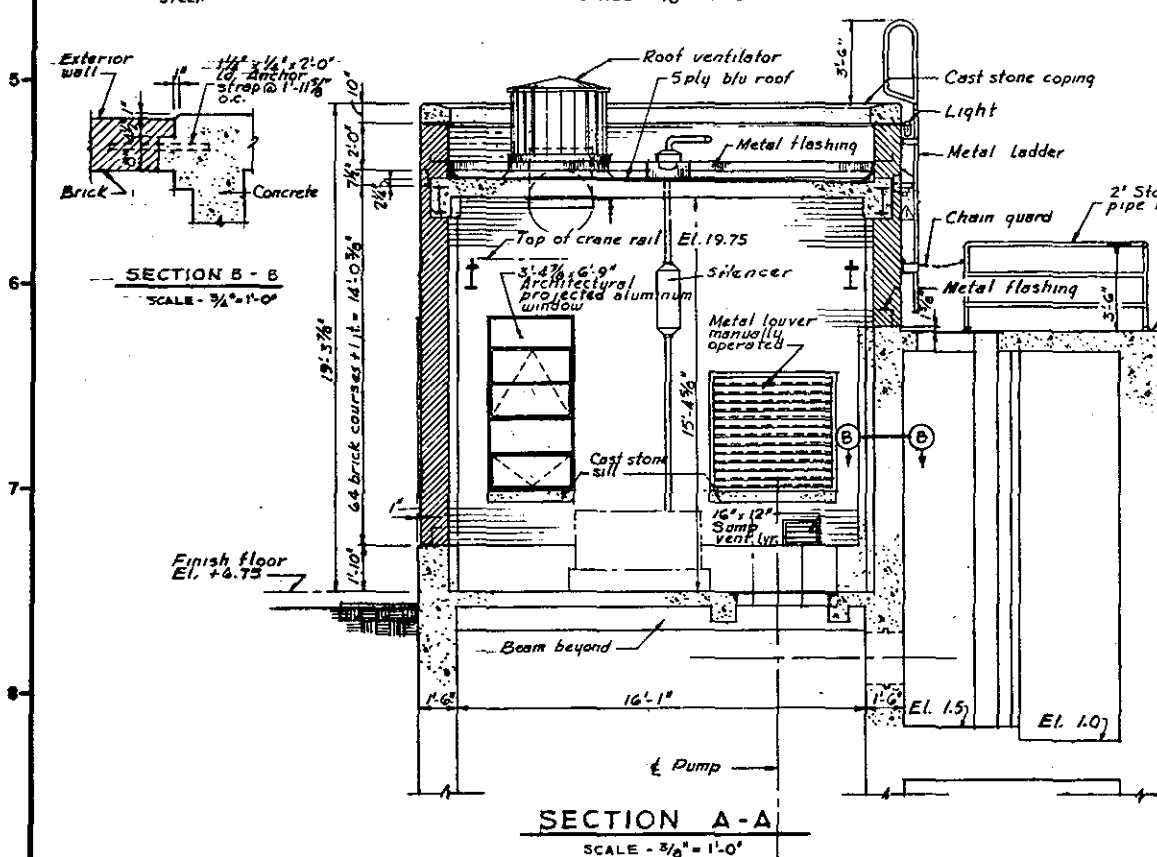
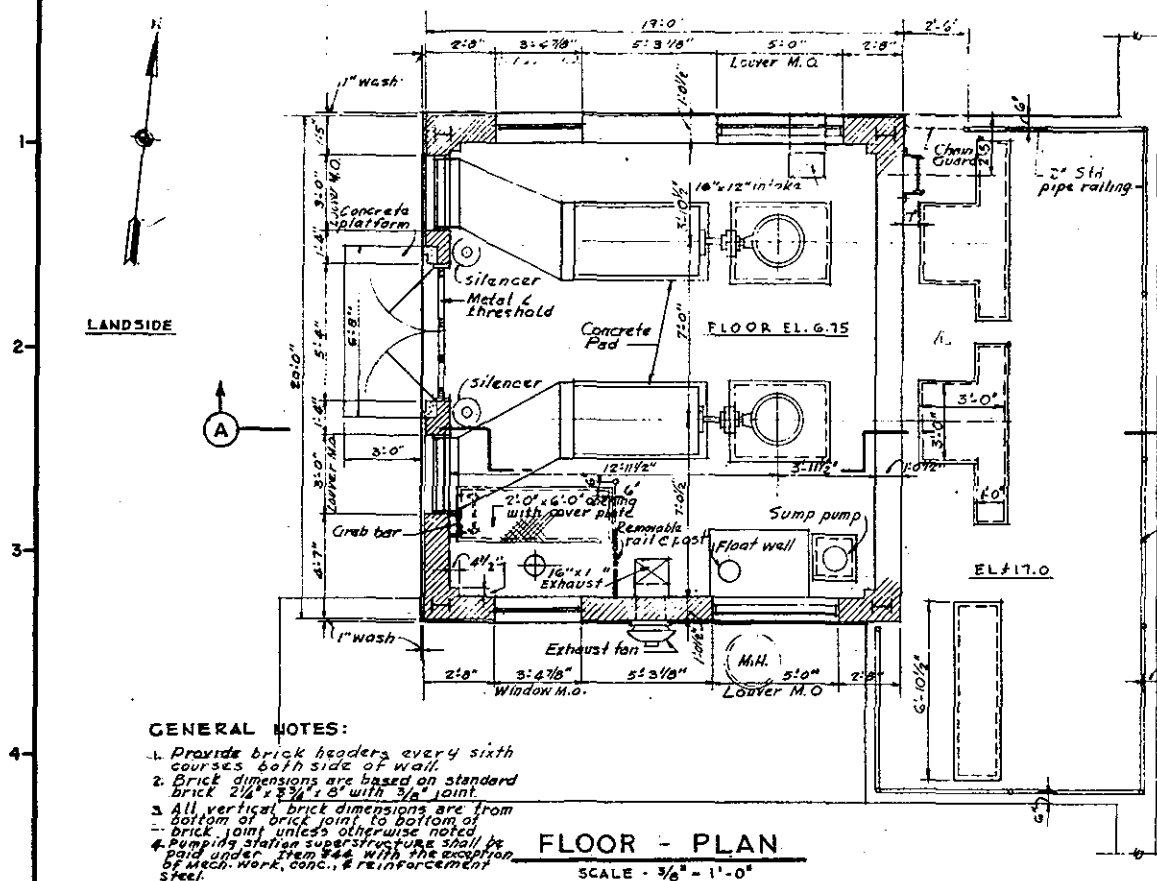
SCALE 1"=4'



REVISION	DATE	DESCRIPTION
7-19-63		Final field corrections
1		Gate abutments and base slab revised. Edge of dike revised. New abutment added. Note revised (Add #1)
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.		
HURRICANE PROTECTION PAWCATUCK, CONNECTICUT LOCAL PROTECTION PROJECT NORTH AND SOUTH VEHICULAR GATES PLANS AND SECTIONS		
PAWCATUCK RIVER		CONNECTICUT
APPROVED: [Signature]		DATE FEB. 1962
SCALE AS SHOWN SPEC. NO. CIV. ENG. 15-016-62-36		DRAWING NUMBER
PHB-1-1025		SHEET 11







Record Drawing

Contract No. DA-19-016 CIV ENG-62-307

3-1-62 Downspout omitted, brick haunch added. (Add'l) No. 58

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.HURRICANE PROTECTION
PAWCATUCK, CONNECTICUTLOCAL PROTECTION PROJECT
PUMPING STATION-ARCHITECTURALPLANS, ELEVATION AND SECTIONS
PAWCATUCK RIVER, CONNECTICUT

APPROVED: [Signature] DATE: FEB. 1962

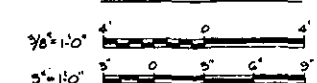
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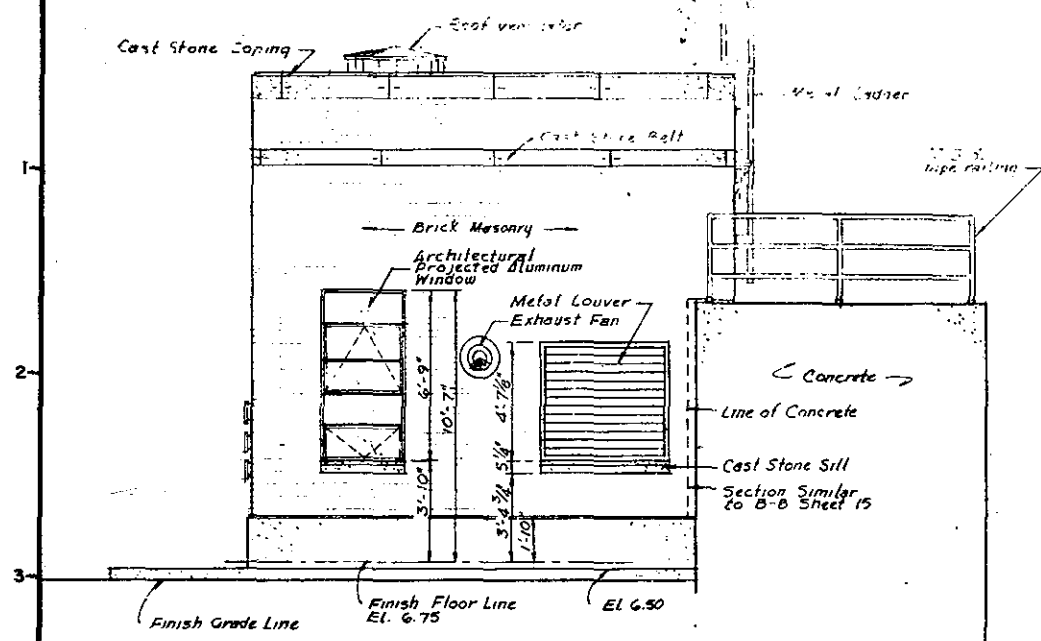
DRAWING NUMBER

PHB-1-1029

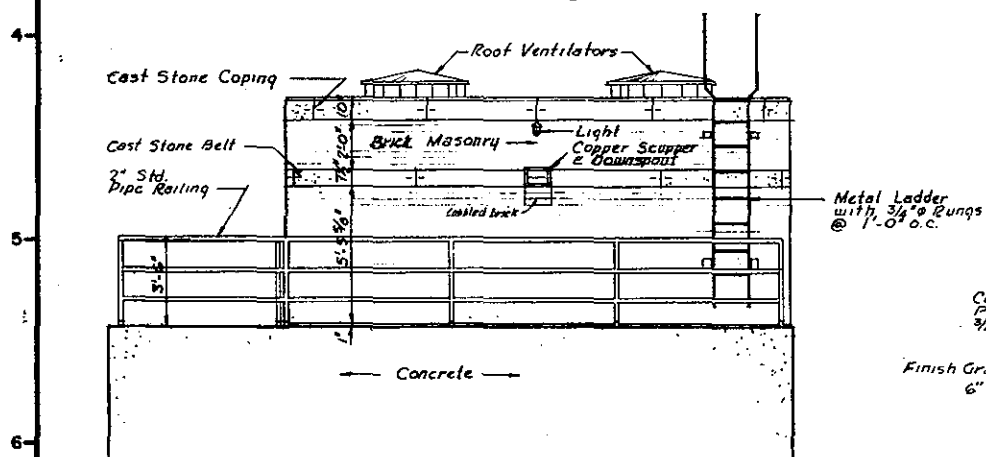
SHEET 15

GRAPHIC SCALES

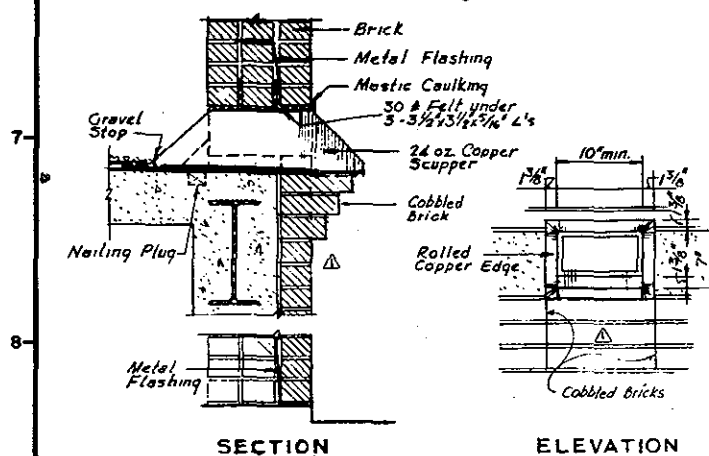




SOUTH ELEVATION

SCALE: $\frac{3}{8}" = 1'-0"$ 

EAST ELEVATION

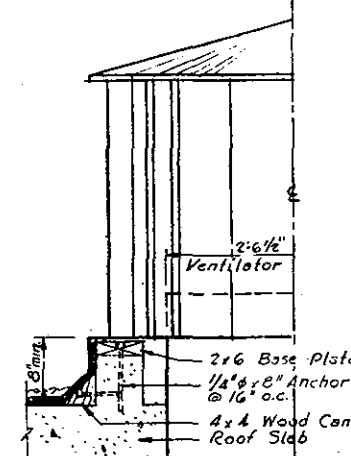
SCALE: $\frac{3}{8}" = 1'-0"$ 

SECTION

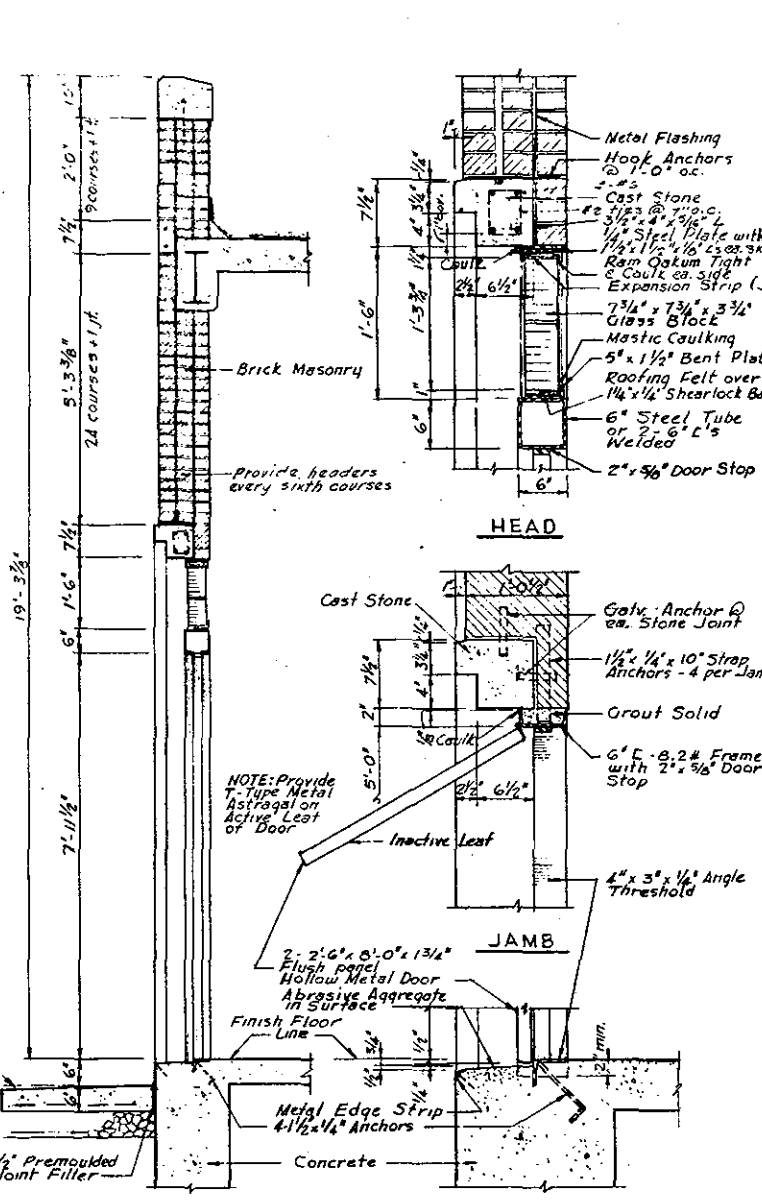
SCUPPER DETAILS

SCALE: $\frac{1}{2}" = 1'-0"$

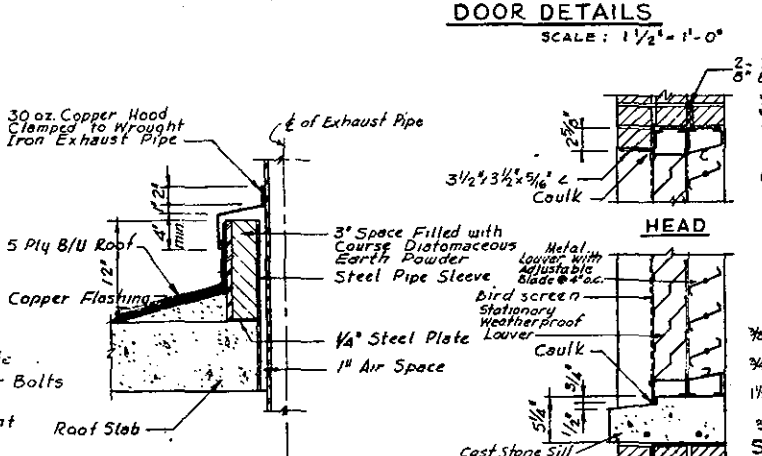
ELEVATION



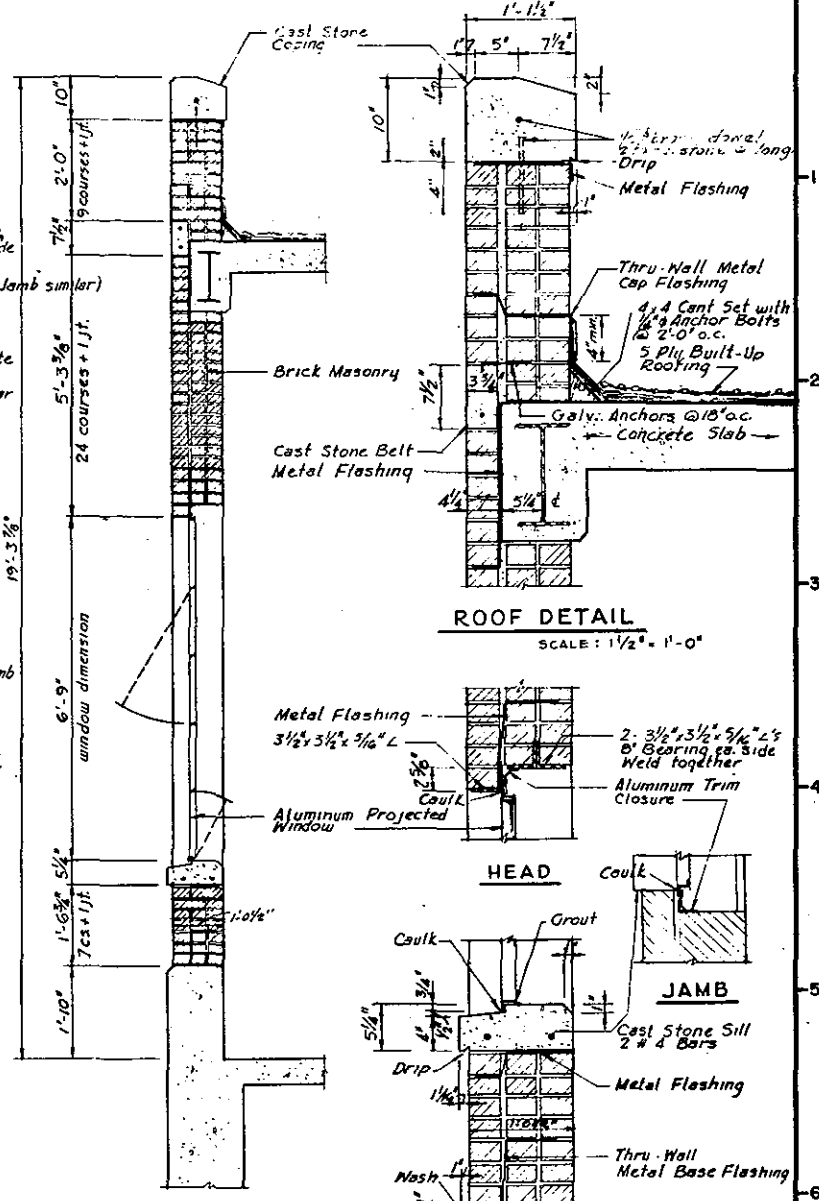
VENTILATOR DETAIL

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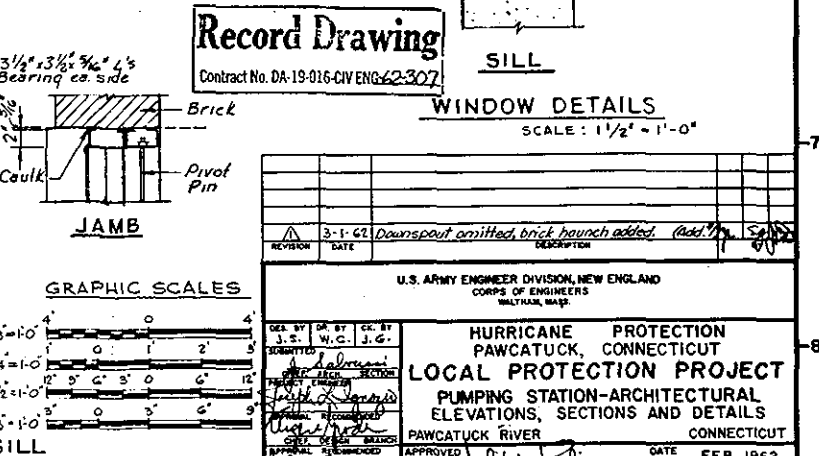
SECTION THRU DOOR

SCALE: $\frac{3}{4}" = 1'-0"$ 

DOOR DETAILS

SCALE: $\frac{1}{2}" = 1'-0"$ 

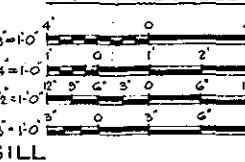
SECTION THRU WINDOW

SCALE: $\frac{3}{4}" = 1'-0"$ 

WINDOW DETAILS

SCALE: $\frac{1}{2}" = 1'-0"$ Record Drawing
Contract No. DA-19-016-CIV-ENG-62-307

GRAPHIC SCALES



LOUVER DETAILS

SCALE: $\frac{1}{2}" = 1'-0"$

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND

CORPS OF ENGINEERS
WALTHAM, MASS.HURRICANE PROTECTION
PAWCATUCK, CONNECTICUT

LOCAL PROTECTION PROJECT

PUMPING STATION-ARCHITECTURAL

ELEVATIONS, SECTIONS AND DETAILS

PAWCATUCK RIVER CONNECTICUT

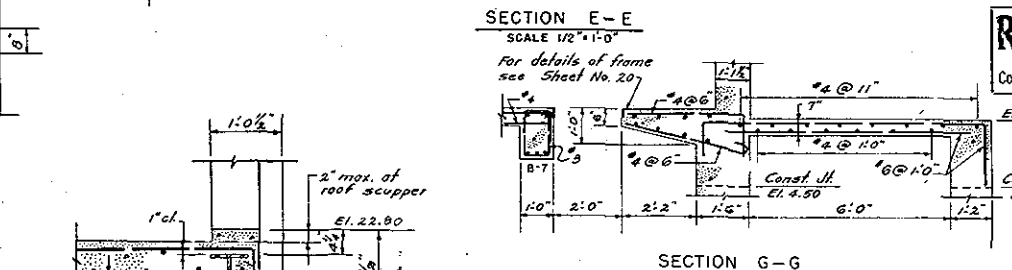
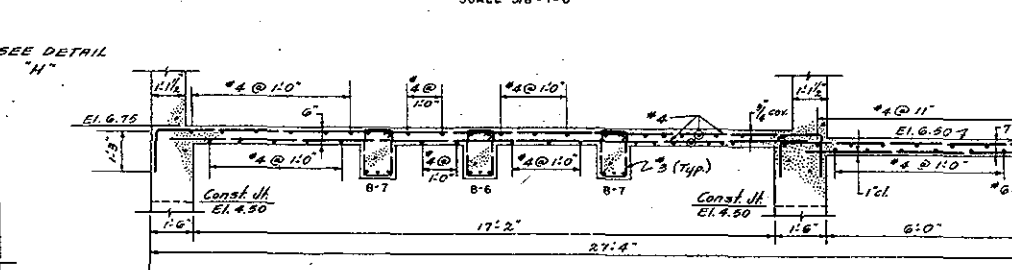
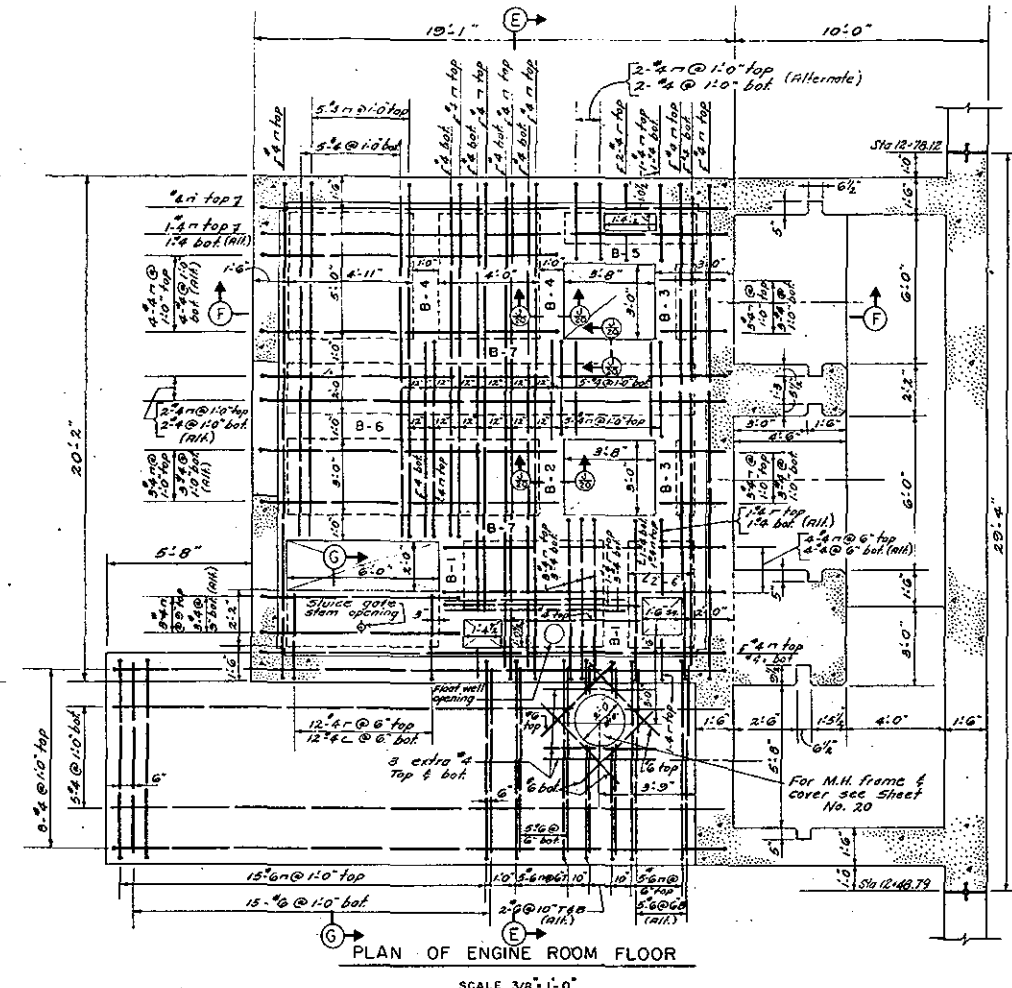
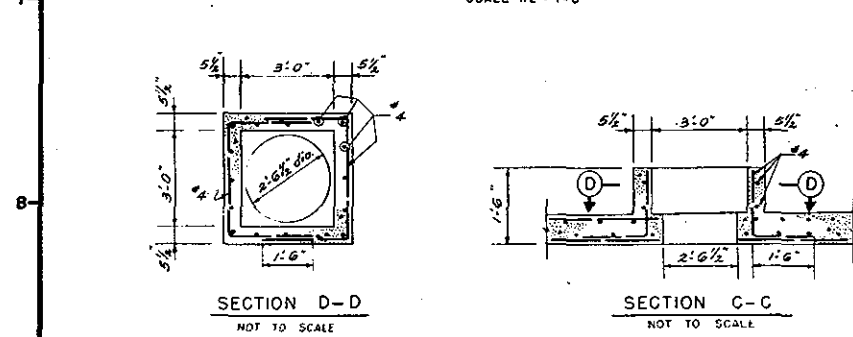
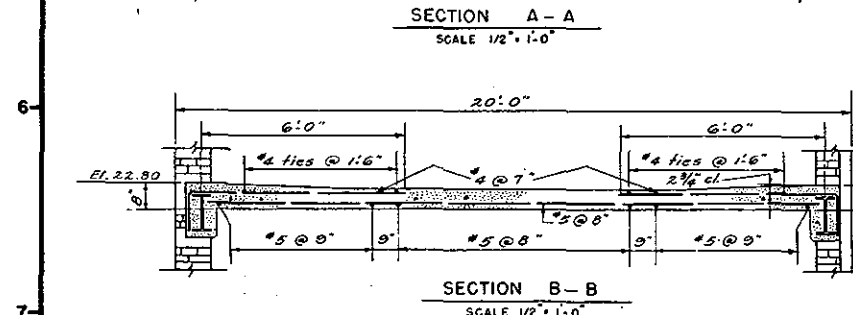
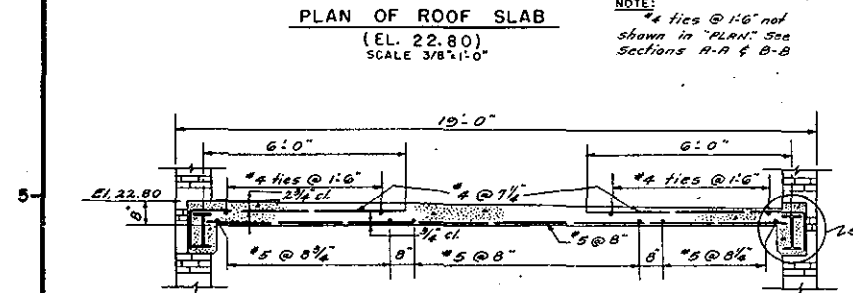
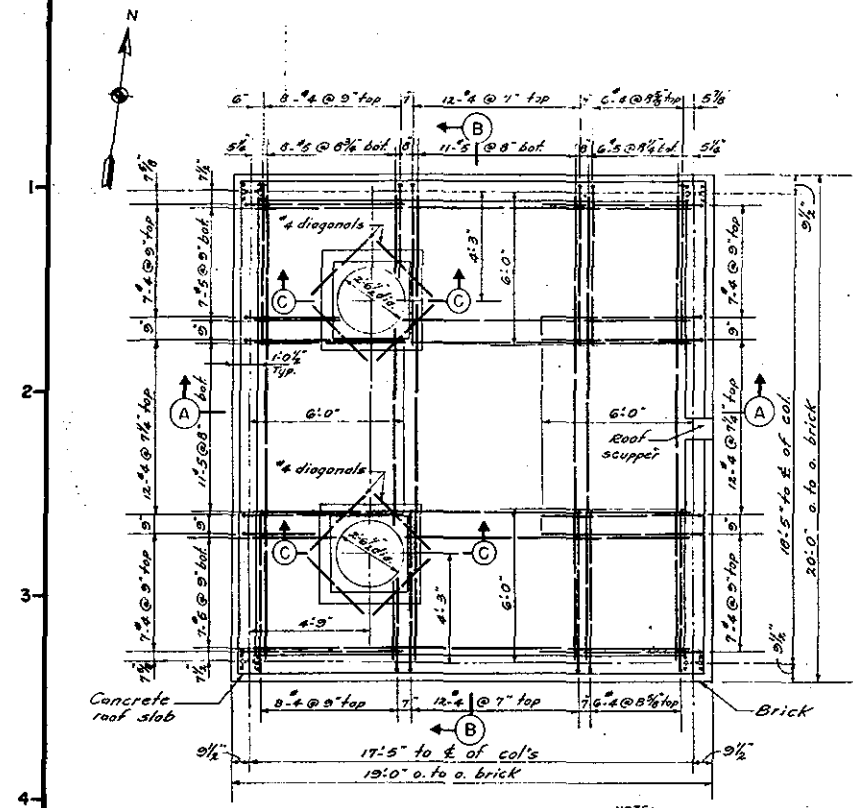
APPROVED DATE FEB. 1962

SCALE AS SHOWN SPEC. NO. CIV. ENG. 19-018-62-38

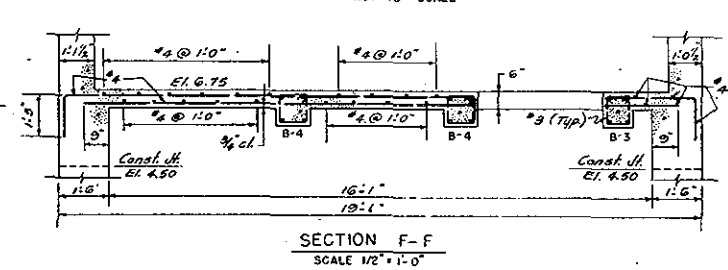
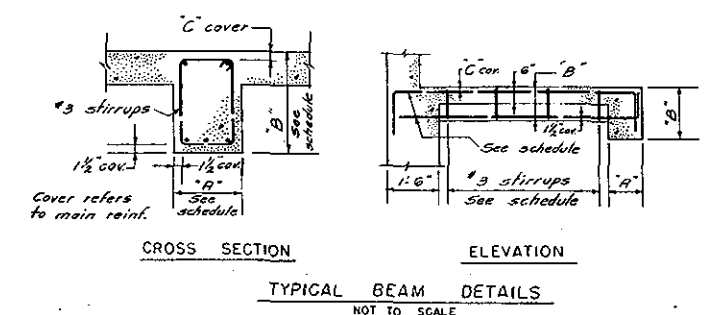
DRAWING NUMBER

PHB-1-1030

SHEET 16



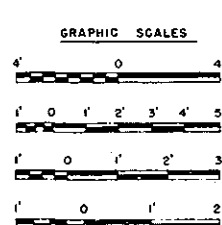
ENGINE ROOM BEAM SCHEDULE					
BEAM	SIZE	REINFORCING	STIRRUPS	"G" COVER	
B-1	1'-0" x 1'-0"	2-#4 TOP 2-#5 BOT	#3 @ 1'-0" c.c.	2-3/8"	
B-2	1'-0" x 1'-0"	2-#4 TOP 2-#5 BOT	" " "	2-3/8"	
B-3	1'-0" x 1'-0"	2-#4 TOP 2-#5 BOT	" " "	2-3/8"	
B-4	1'-0" x 1'-2"	2-#4 TOP 2-#5 BOT	" " "	2-3/8"	
B-5	1'-0" x 1'-0"	2-#4 TOP 2-#5 BOT	" " "	1-1/2"	
B-6	1'-0" x 1'-6"	2-#6 TOP 3-#7 BOT	" " "	1-3/4"	
B-7	1'-0" x 1'-6"	2-#7 TOP 3-#8 BOT	" " "	1-1/2"	



GENERAL NOTES:
All reinforcing steel splices and laps to be 30 dia. unless otherwise noted.
Chamfer all exposed corners 1".
Payment for concrete will be made under Item No. 80.
Payment for reinforcing steel will be made under Item No. 81.
For location of pipe sleeves and embedded items see Sheets No. 21, 22 & 23.

NOTES:
All roof beams to be wrapped with 16 gauge 3"x3" wire mesh.
For structural steel framing and details see Sheet No. 20.
See Sheets No. 15 & 16 for details of holes required in roof for silencer exhaust pipes.

Record Drawing
Contract No. DA-19-016-CIV-ENG-62-307



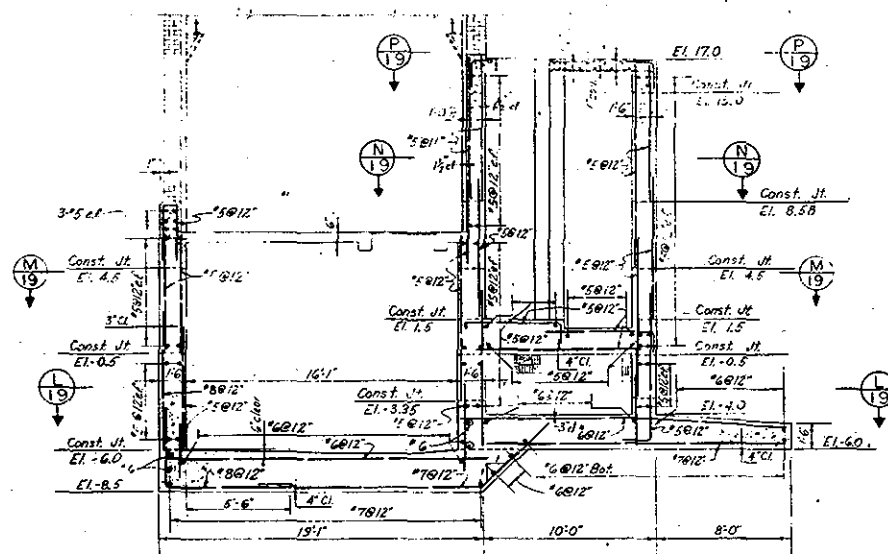
REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
MILITARY, MASS.

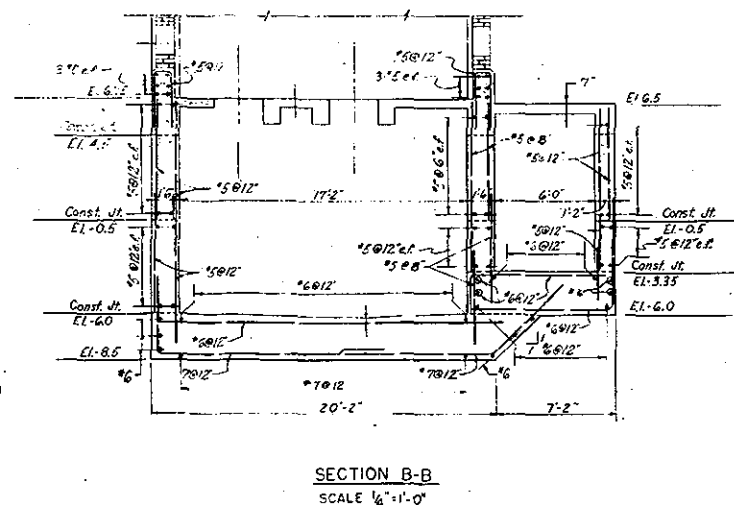
HURRICANE PROTECTION
PAWCATUCK, CONNECTICUT
LOCAL PROTECTION PROJECT
PUMPING STATION-STRUCTURAL
REINFORCING DETAILS NO. 1
PAWCATUCK RIVER CONNECTICUT

DATE FEB 1962

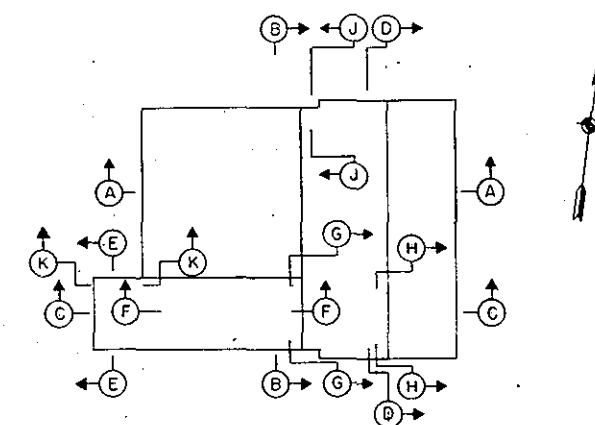
SCALE AS SHOWN SPEC. NO. CIV. ENG. 19-016-62-38
DRAWING NUMBER PHB-1-1031
SHEET 17



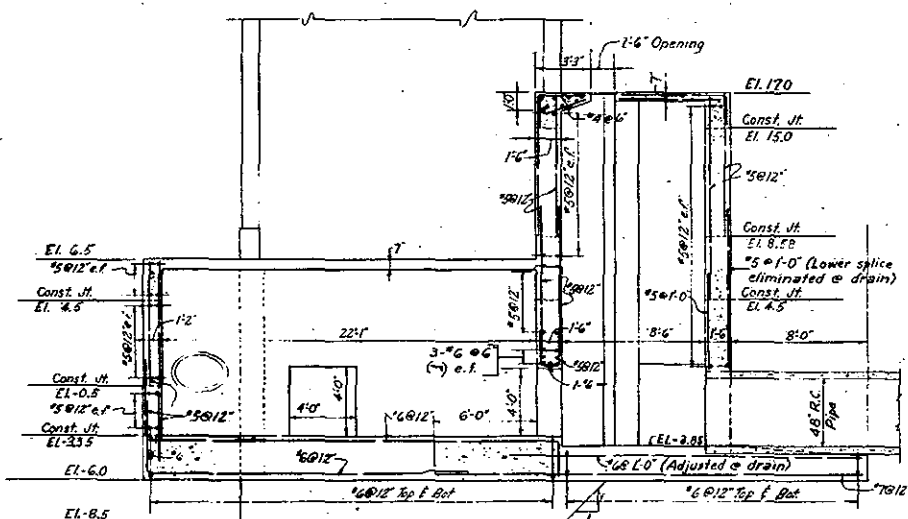
SECTION A-A
SCALE 1/4" = 1'-0"



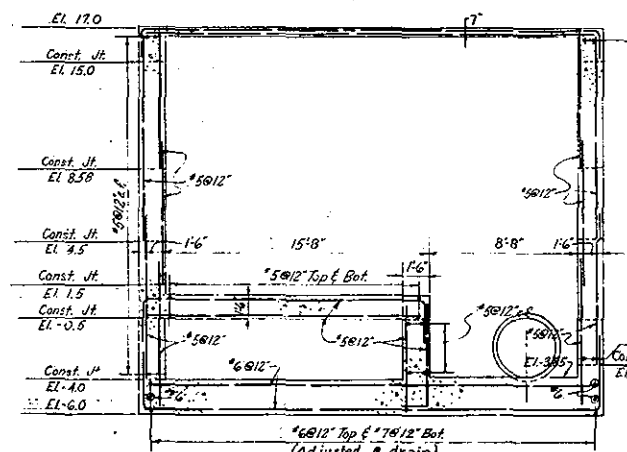
SECTION B-B
SCALE 1/4"=1'-0"



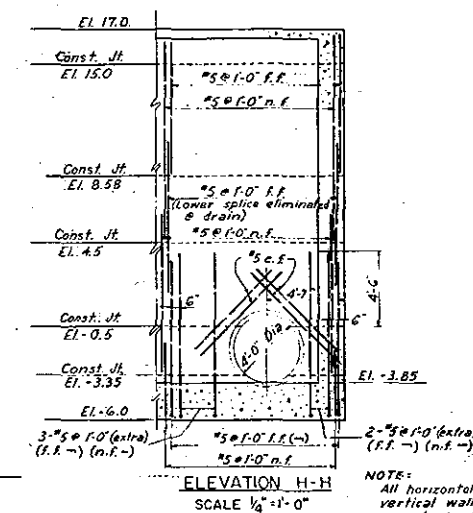
KEY PLAN
SCALE $\frac{1}{8}" = 1'-0"$



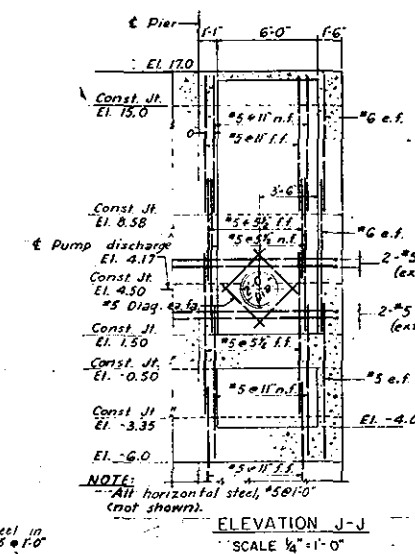
SECTION C-C
SCALE 1/8" = 1'-0"



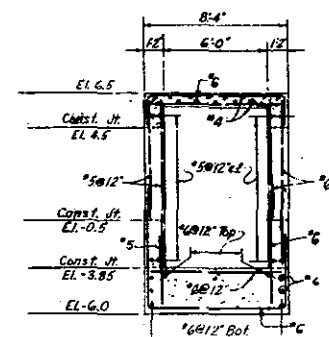
SECTION D-D
SCALE 1/2" = 1'-0"



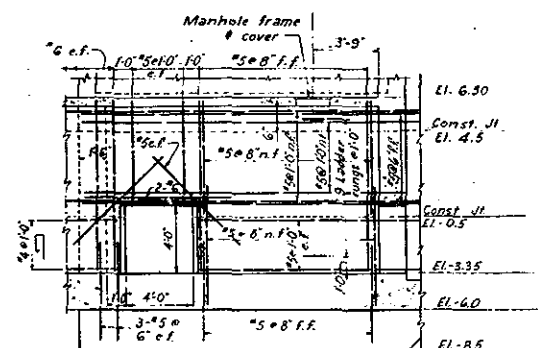
ELEVATION
SCALE $\frac{1}{8}'' = 1'$



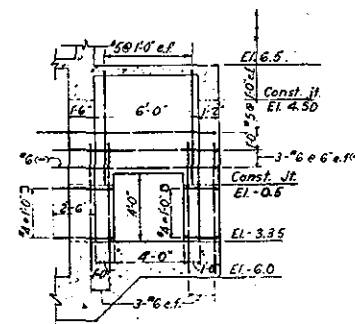
ELEVATION
SCALE 1/4" = 1'



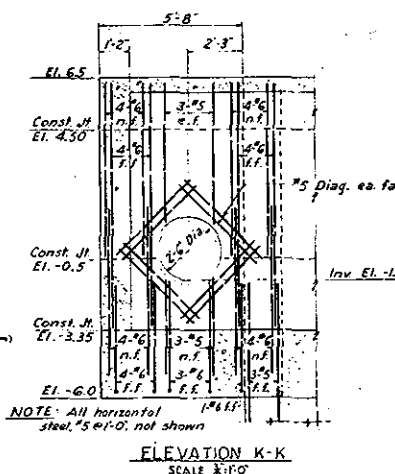
SECTION E-E
SCALE $\frac{1}{8}" = 1'-0"$



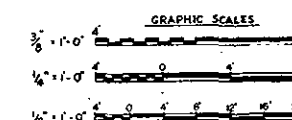
ELEVATION F-F
SCALE 1/4" = 1'-0"



ELEVATION G-G
SCALE $\frac{1}{4}" = 1'-0"$



ELEVATION K-
SCALE 3"=1'-0"



- NOTES:
1. For "General Notes," see Sh. No. 17
 2. For details of manhole frame and cover and ladder rungs see Sh. No. 20

Record Drawing

Contract No. DA-19-016-CIV ENG-62-302

[illegible]

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HURRICANE PROTECTION
PAWCATUCK, CONNECTICUT
LOCAL PROTECTION PROJECT
PUMPING STATION-STRUCTURAL
REINFORCING DETAILS NO. 2

PAWCATUCK RIVER CONNECTICUT

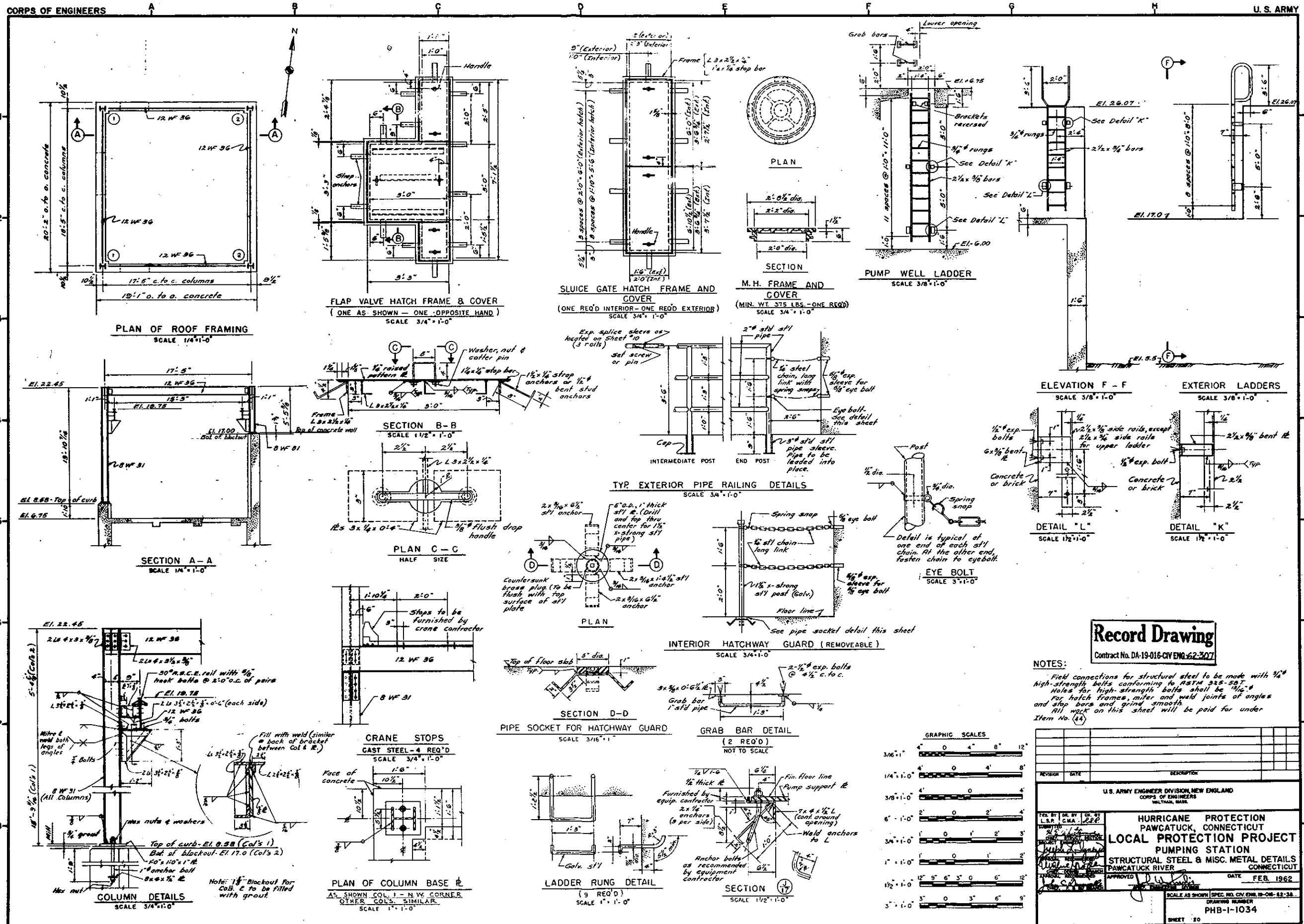
APPROVED [Signature] DATE FEB. 1962

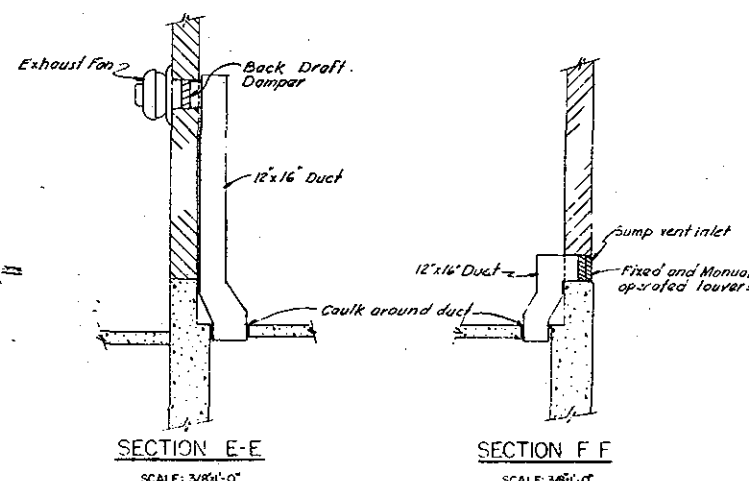
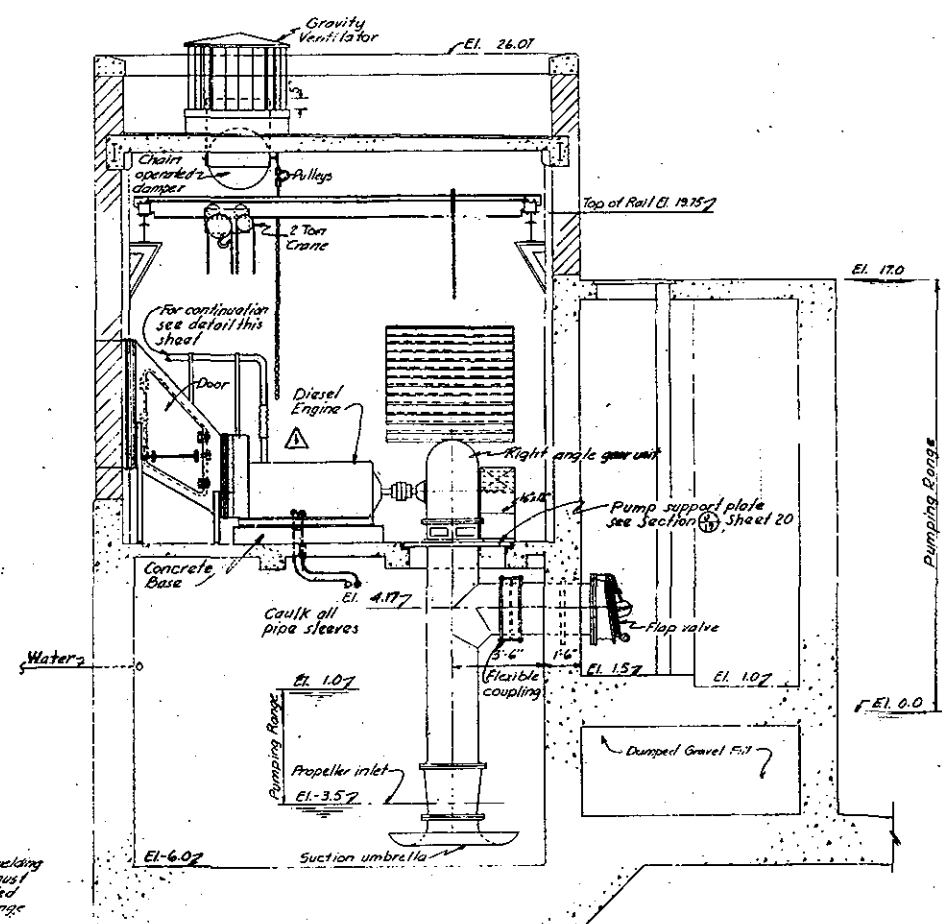
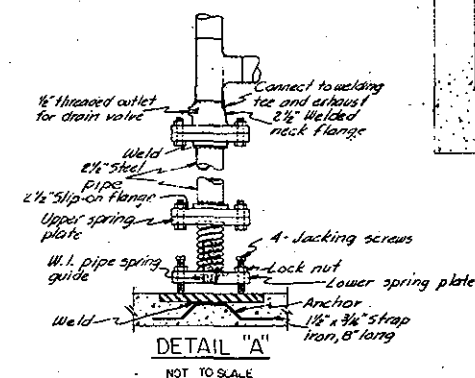
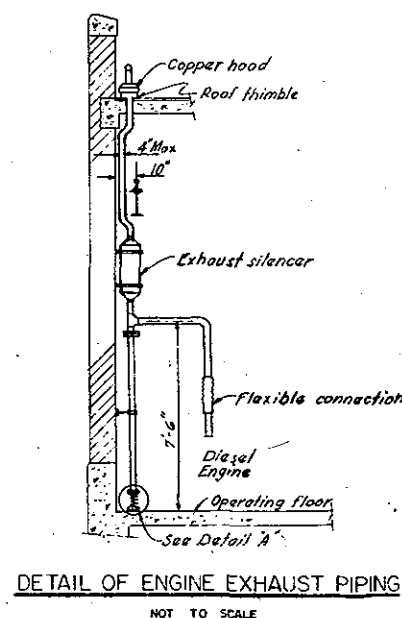
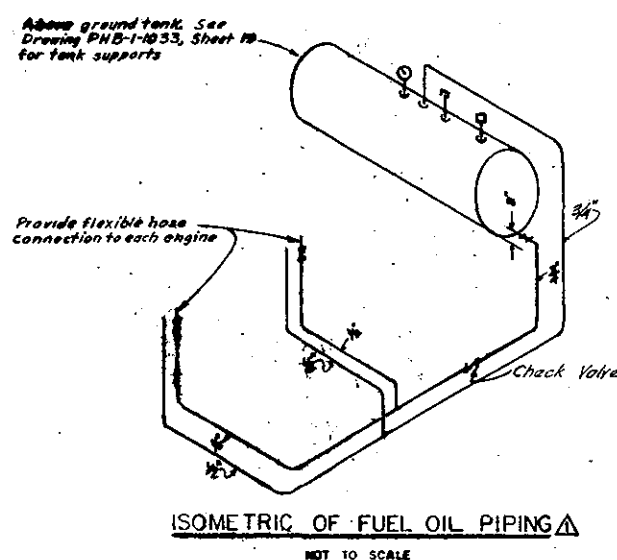
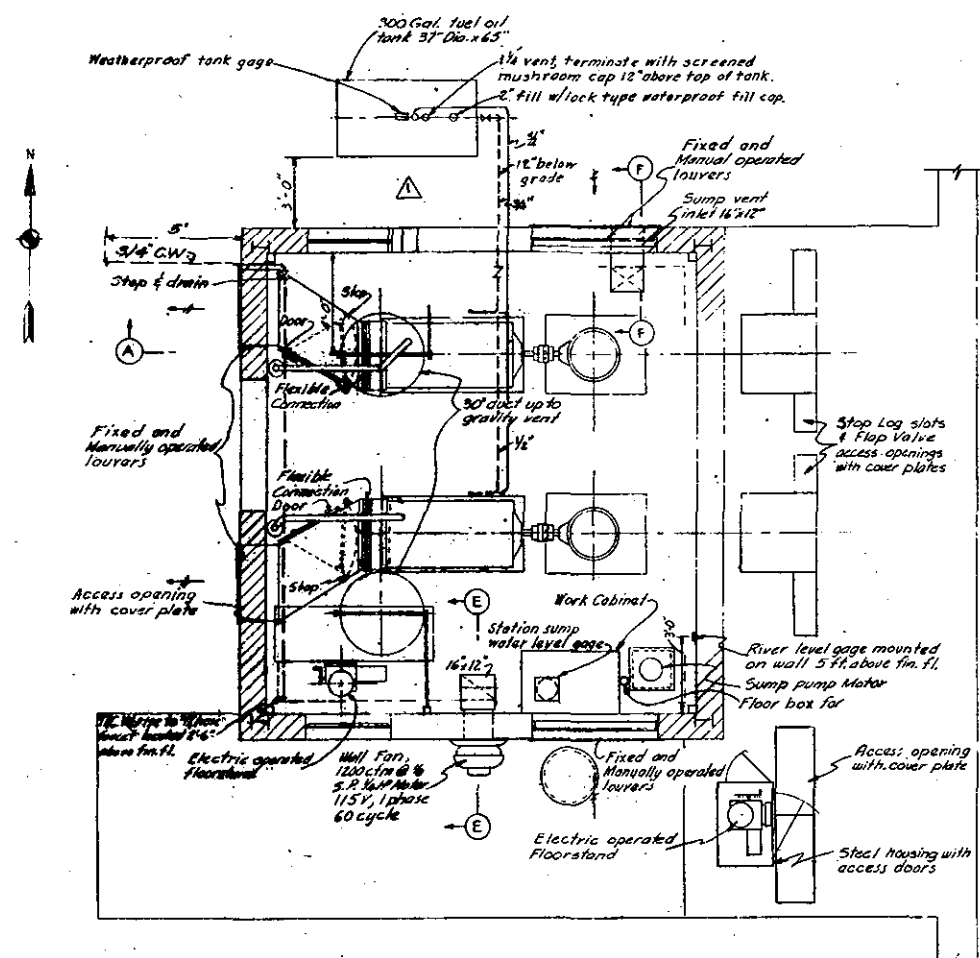
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SCALE AS SHOWN	SPEC. NO. CIV. ENGR. 12-01-00-00-00
DRAWING NUMBER	

PHB-1-1032







Record Drawing

Contract No. DA-19-016-CIV ENG 62-307

NOTES:

Notes:

- 1. Furnishing and installation of the axial flow pumps, right angle drive with electric motor, pump, and piping and appurtenances is specified in Section 18, will be paid for under Item No. 45.
- 2. Furnishing and installation of the sluice gates as specified in Section 19, will be paid for under Item No. 46.
- 3. Furnishing and installation of the traveling crane as specified in Section 20, will be paid for under Item No. 45.
- 4. Furnishing and installation of the ventilating system as specified in Section 17, will be paid for under Item No. 44.
- 5. Furnishing and installation of the electric motors as specified in Section 22, will be paid for under Item 44.

7-1943	<i>Final field corrections</i>			
3-1-42	<i>Painting Range on discharge side added.</i>			
	<i>Fuel tank raised to above ground fuel pump raise</i>			
	<i>Priming Tank & hand fuel pump deleted. (Add?)</i>			
REVISION	DATE	DESCRIPTION		

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HURRICANE
PAWCATUCK, CONNECTICUT

LOCAL PROTECTION PROJECT

PUMPING STATION - MECHANICAL

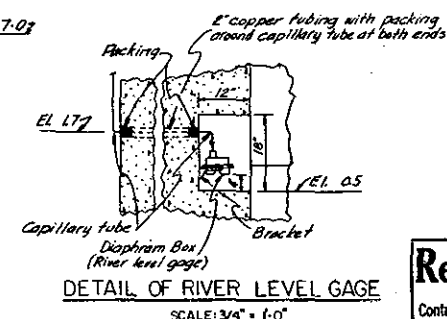
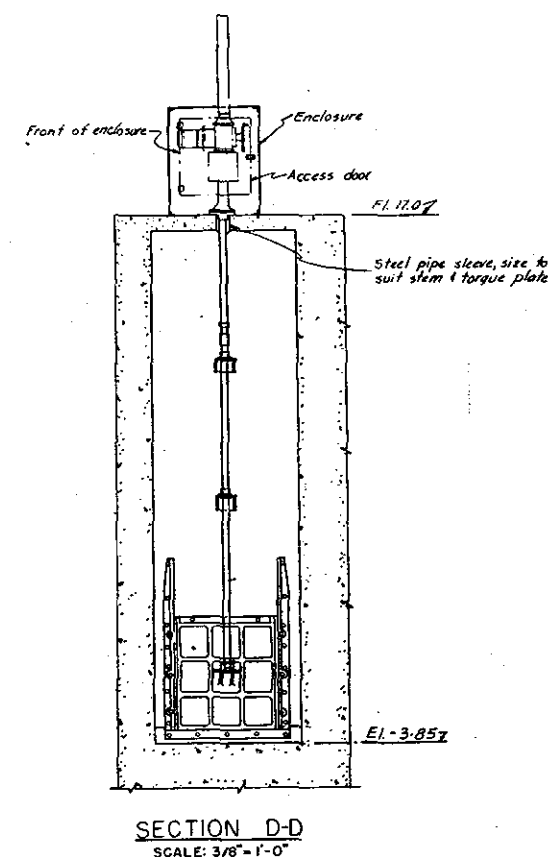
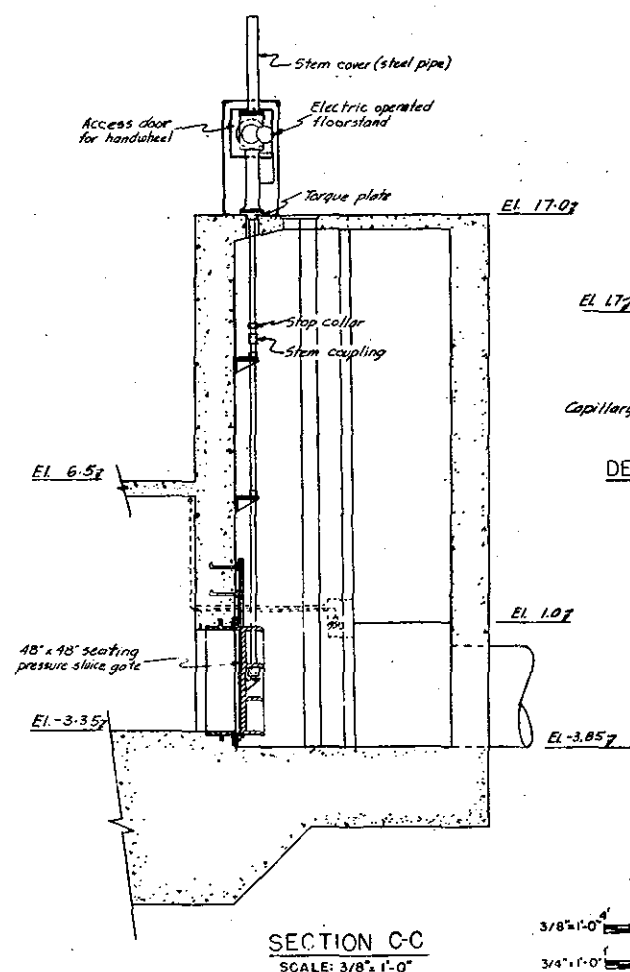
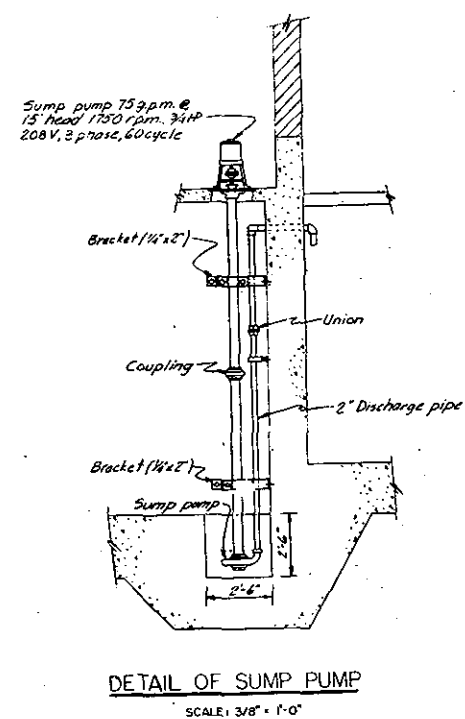
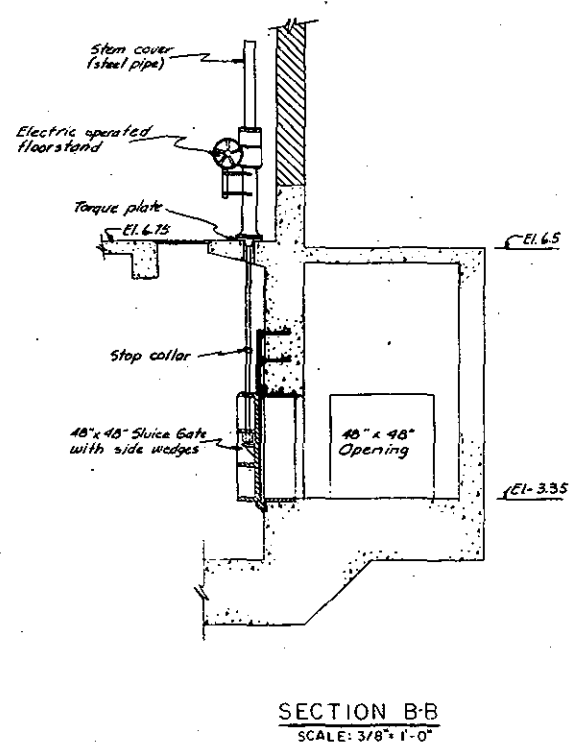
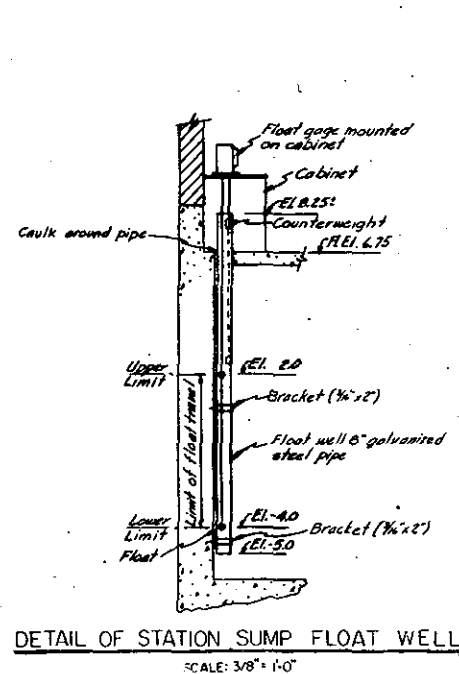
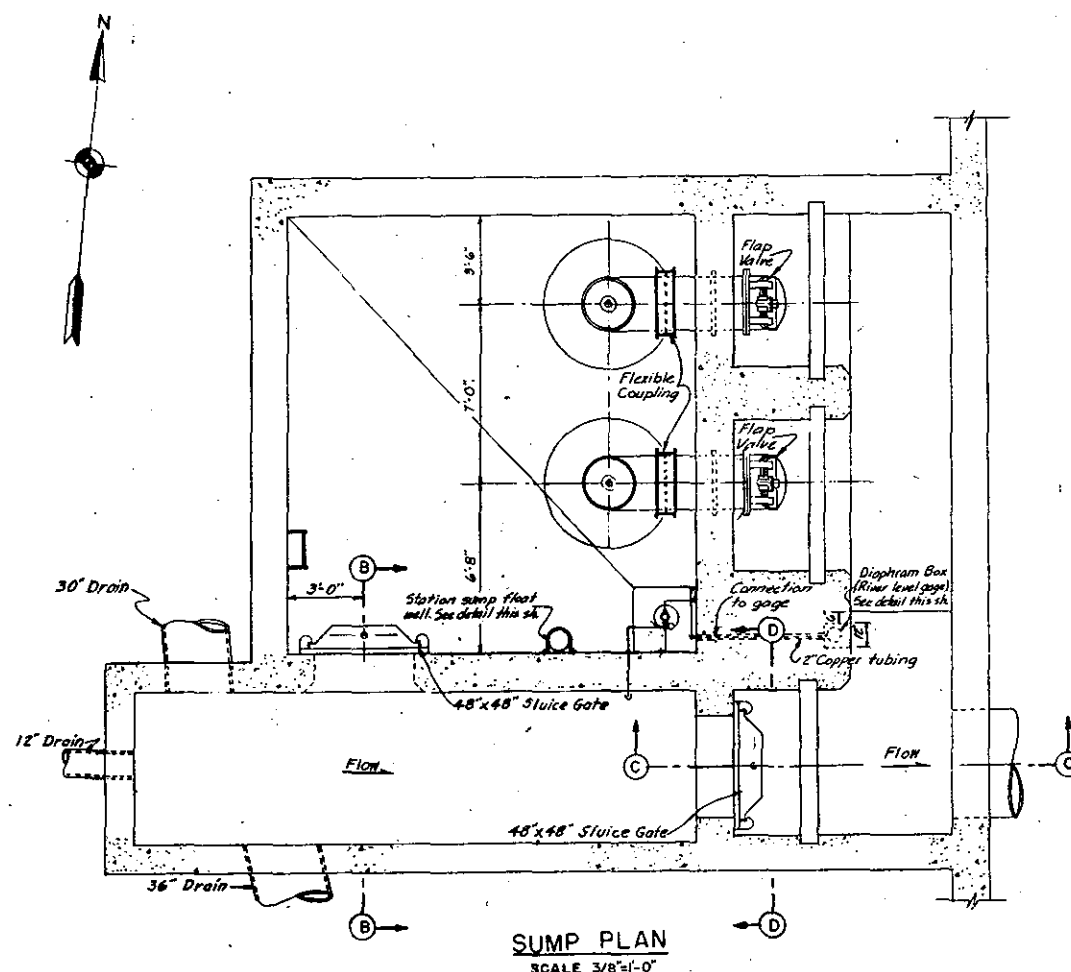
PLANS, SECTIONS AND DETAILS NO. 1

PAWCATUCK RIVER CONNECTICUT

APPROVED *[Signature]* DATE FEB. 1962

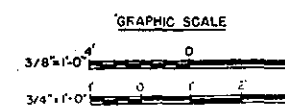
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DRAWING NUMBER
PHB-1-1035

SHEET 21

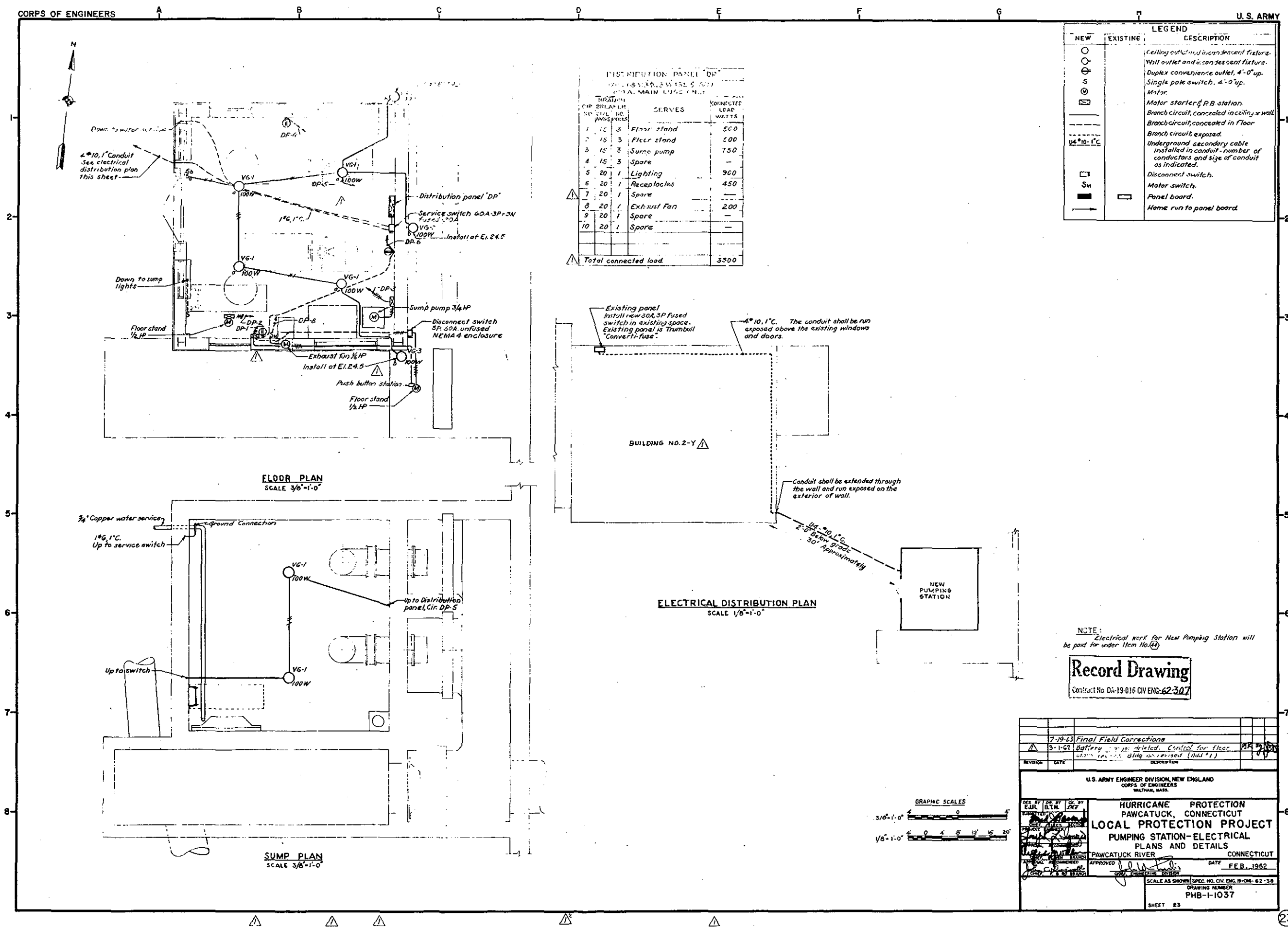


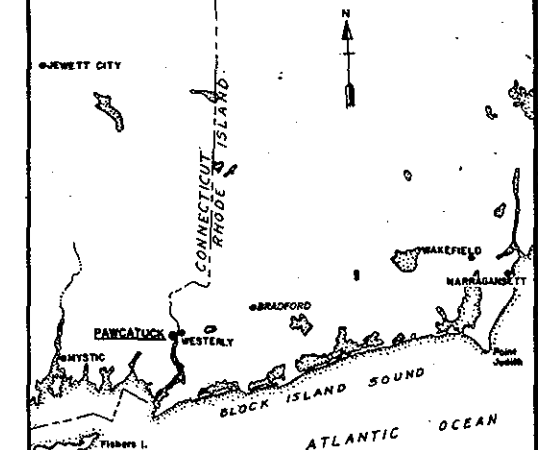
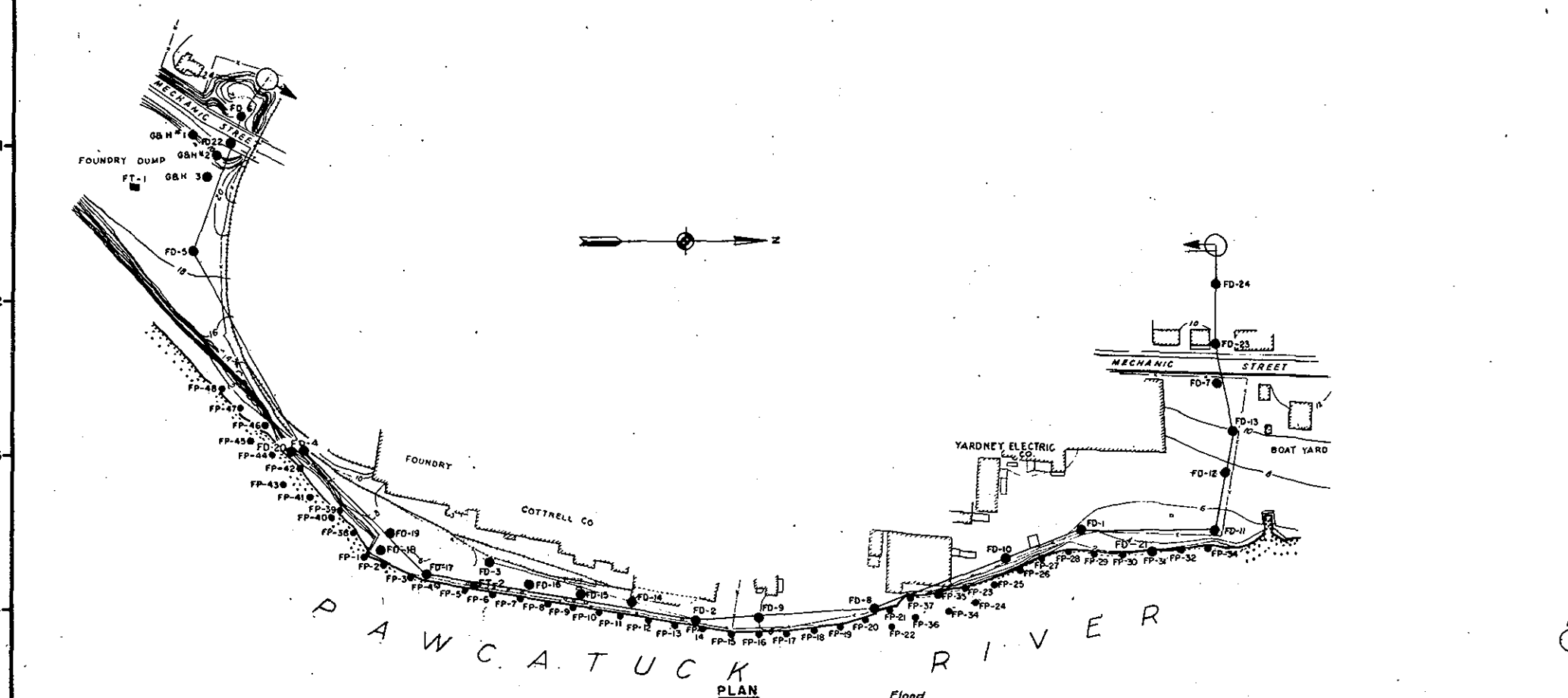
Record Drawing
Contract No. DA-19-016-CIV ENG-62-307

NOTE:
For payment item numbers see sheet No. 21.



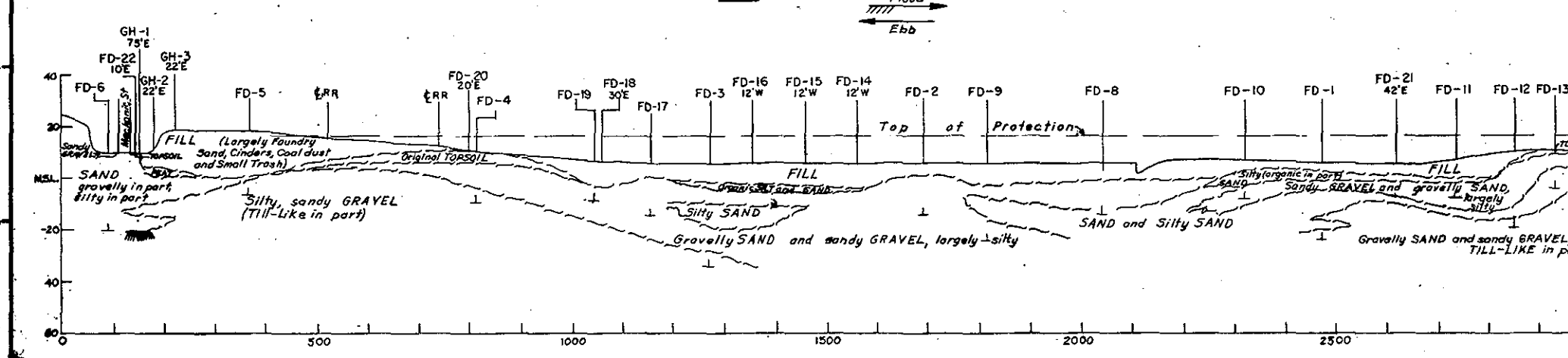
7-19-13		Final field corrections		BY
REVISION	DATE	DESCRIPTION		BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.				
HURRICANE PROTECTION PAWCATUCK, CONNECTICUT LOCAL PROTECTION PROJECT PUMPING STATION-MECHANICAL PLANS, SECTIONS AND DETAILS NO. 2 PAWCATUCK RIVER CONNECTICUT				
APPROVED		DATE		FEB 1962
SCALE AS SHOWN SPEC. NO. CIV. ENG.-19-016-102-30 DRAWING NUMBER PHB-1-1036 SHEET 22				





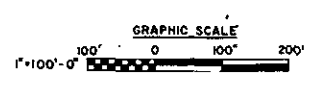
NOTES
Elevations refer to Mean Sea Level Datum.
Contour interval is 2 feet.

LEGEND
FD Foundation Test Boring
FT Foundation Test Pit
FP Foundation Probing
Location of Geologic Section
Test Boring by Gibbs and Hill, Inc., Engineers, May 1931.
Assumed bedrock surface
Bottom of exploration

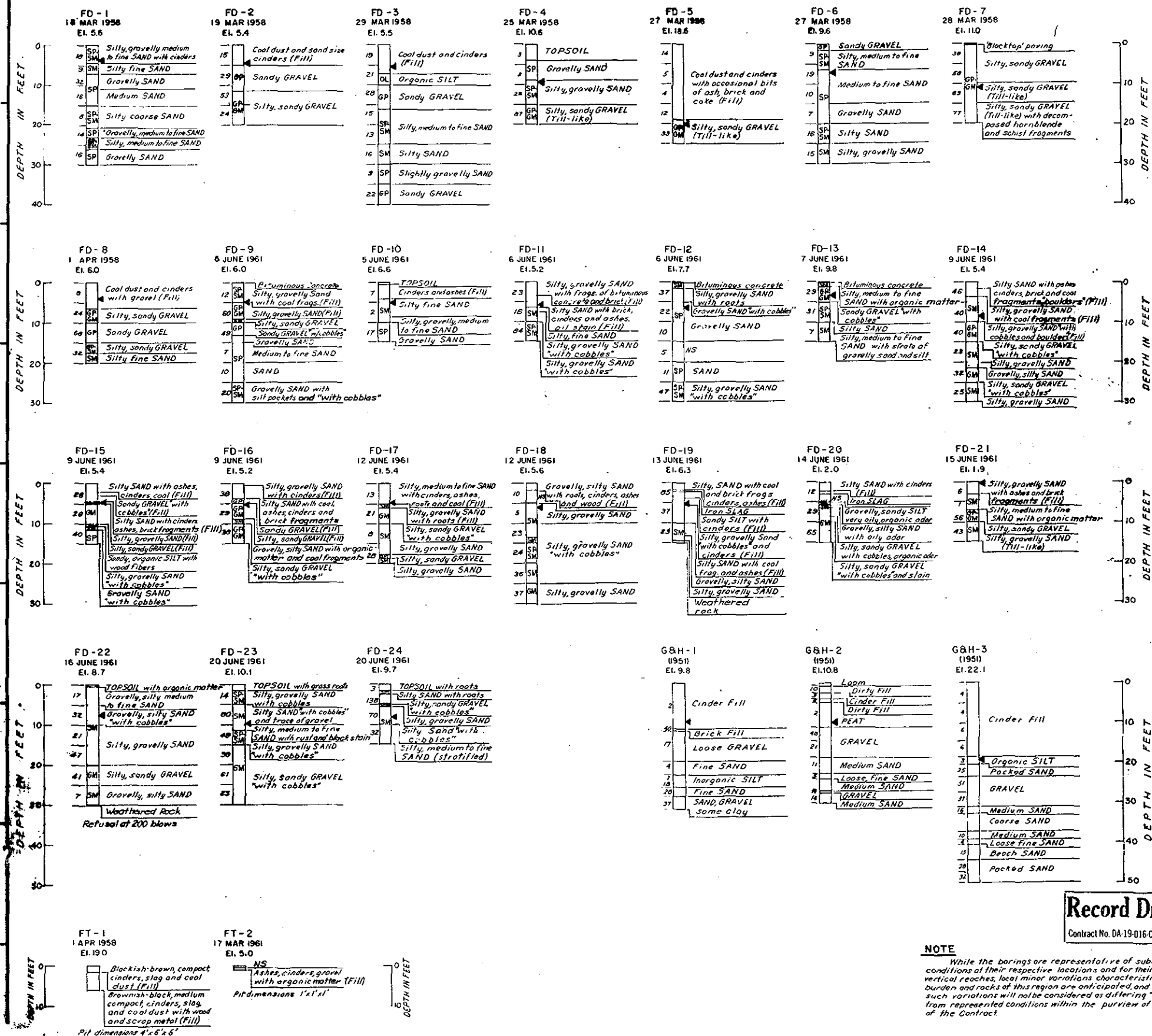


Record Drawing
Contract No. DA-19-016-CIV ENG-2307

NOTE
The geologic section shown hereon is Government interpretation of subsurface conditions believed to exist and between borings. Variations between elevations, compositions and structure of the individual formations are represented hereon and as actually encountered in the progress of work are to be anticipated.



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DES. BY	CHK. BY	APP. BY	DATE
W. H. HARRIS	H. C. S.	W. C. B.	FEB. 1962
HURRICANE PROTECTION PAWCATUCK, CONNECTICUT LOCAL PROTECTION PROJECT PLAN OF FOUNDATION EXPLORATIONS AND GEOLOGIC SECTION PAWCATUCK RIVER CONNECTICUT			
APPROVED		DATE	
W. H. HARRIS		FEB. 1962	
DRAWING NUMBER PHB-1-1038			
SHEET 24			



PROBING TABLE				PENETRATION DEPTH AND BLOWS/FT. REG. 48 LB HAMMER			
PROBING NUMBER	PENETRATION DEPTH (1 MAN)	PENETRATION DEPTH (2 MEN)	PENETRATION DEPTH (3 MEN)	PENETRATION DEPTH (4 MEN)	PENETRATION DEPTH (5 MEN)	PENETRATION DEPTH (6 MEN)	PENETRATION DEPTH (7 MEN)
FP-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-22	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-23	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-24	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-25	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-26	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-27	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-28	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-38	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-42	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-43	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-46	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-47	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-48	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FP-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NOTE: Fractional part of blow count indicated in parentheses.

LEGEND FOR GRAPHIC LOGS

- FD-9 Foundation Test Pit
FT-1 Foundation Test Pit
5 JUNE 1961 Date exploration completed
El. 6.0 Elevation of ground surface at time of exploration.
Subsurface water level in boring at time of exploration.
Group letter symbol according to Unified Soil Classification System.
NR No Recovery or unsatisfactory soil samples recovered.
NS Not Sampled, Hole advanced by core-drilling, blasting and/or wash-boring due to operational difficulty.
Blows per foot of penetration considered most representative, usually within a 5 foot drive, using a 300 or 350 pound hammer with a free fall of about 18 inches on a 12" I.D. or 2" I.D. or 2" I.D. or 2" I.D. or 3" I.D. size sample spade equipped with a beveled and sharpened drive shoe.
Blow count not recorded or not considered representative.

NOTES
Elevations refer to mean sea level datum.
Subsurface water levels in the explorations are subject to tidal fluctuation.
Borings indicated G&H-1 to G&H-3 were made by Gibbs and Hill, Inc. Engineers, May 1951.
Blow counts indicated on G & H Borings are per foot of penetration of 101" I.D. or 2" I.D. spoon driven by a 300 lb weight with an average free fall distance of 18 inches.
Descriptive terms are those of Gibbs and Hill for their borings.

Record Drawing

Contract No. DA-19-016-CIV-ENG-42307

NOTE

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local minor variations characteristic of the overburden and rocks of this region are anticipated, and if encountered, such variations will not be considered as differing "materially" from represented conditions within the purview of Article 4 of the Contract.

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERSHURRICANE PROTECTION
PAWCATUCK, CONNECTICUT
LOCAL PROTECTION PROJECTRECORD OF FOUNDATION EXPLORATIONS
PAWCATUCK RIVER CONNECTICUT

APPROVED: J. D. Hill DATE: FEB. 1962

DRAWING NUMBER
PHB-1-1039

SHEET 25